Sent to Di
July 97

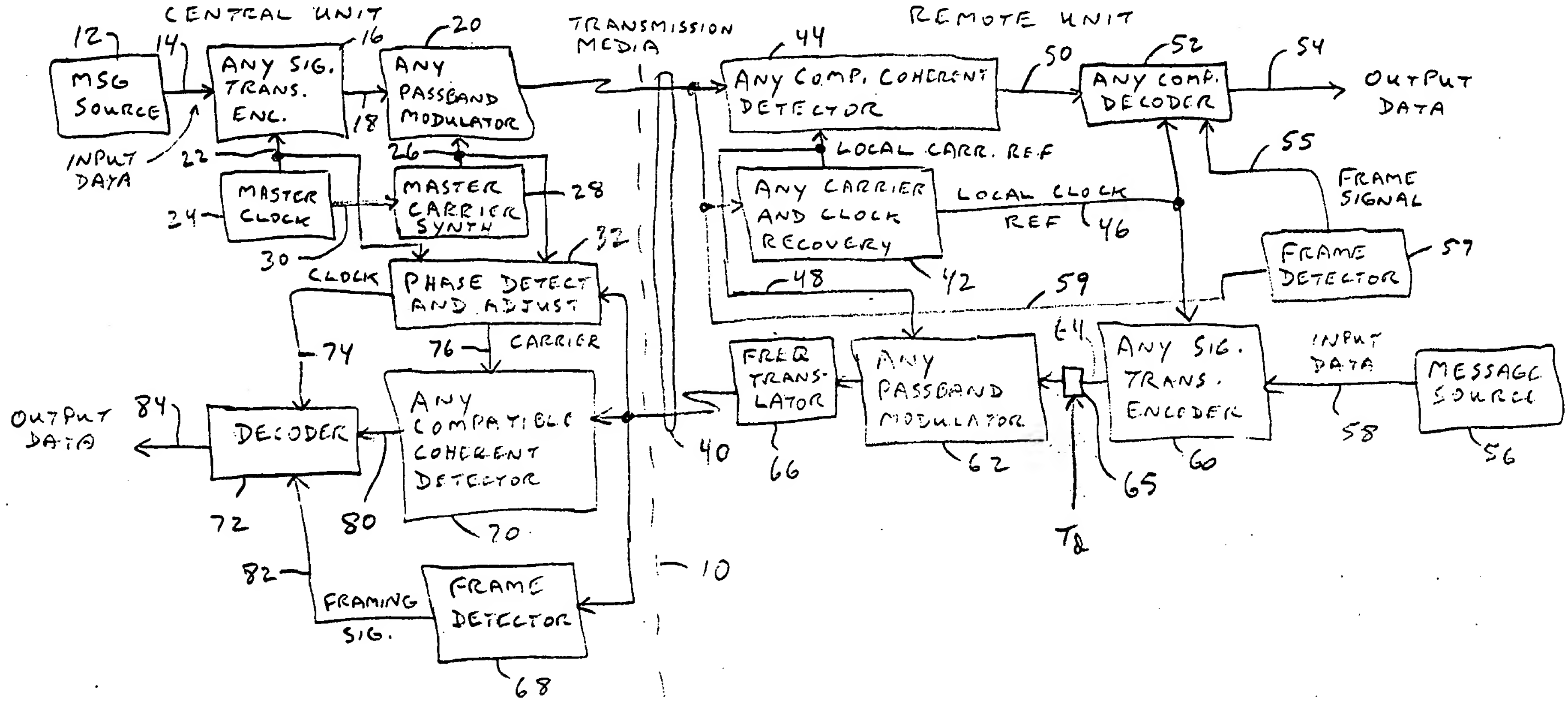


FIG. 1

0076'720.011601

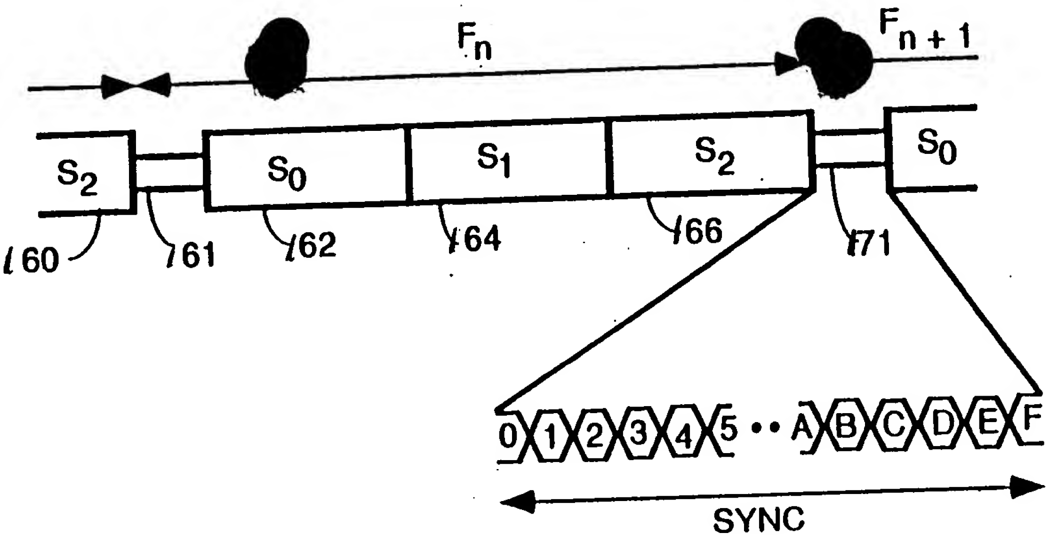


FIG. ~~4A~~ 2A

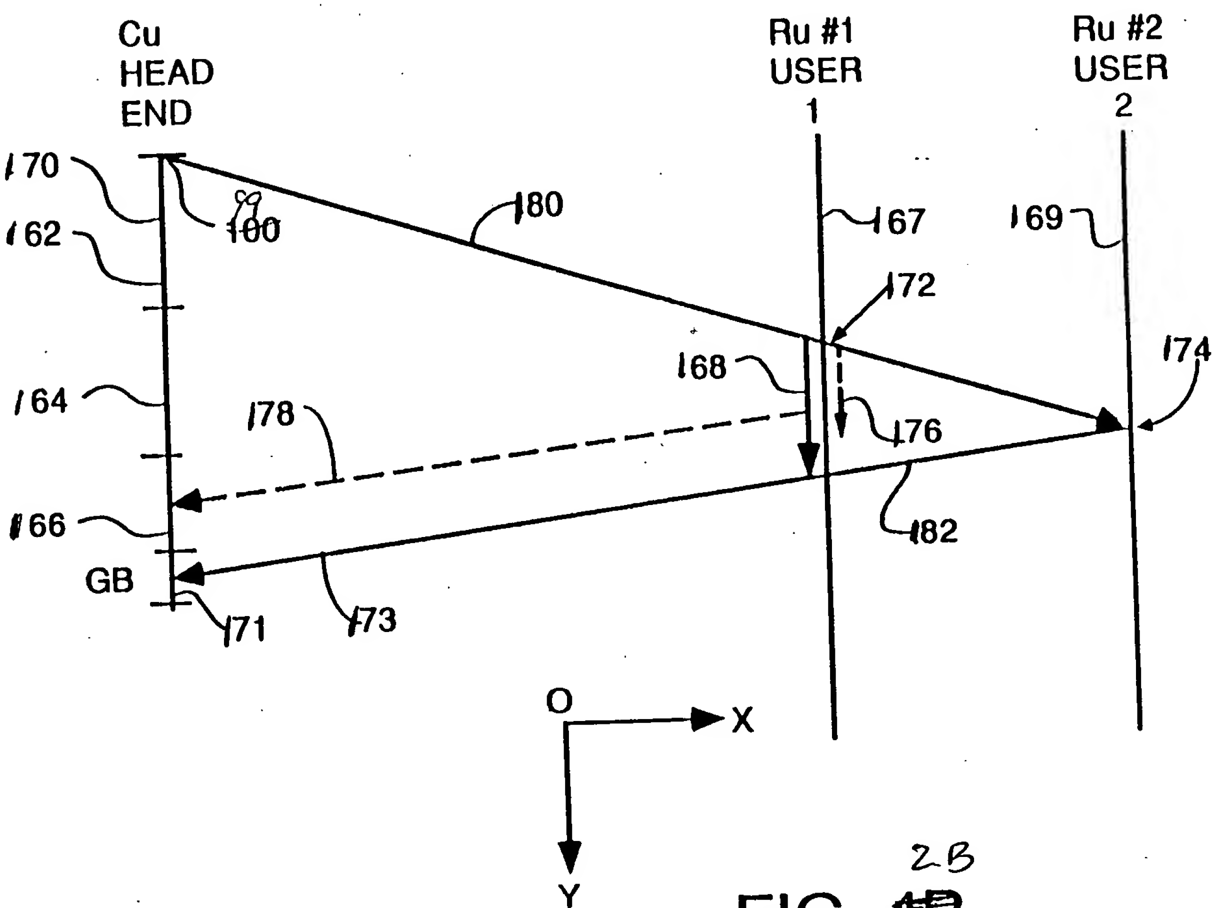


FIG. ~~4B~~ 2B

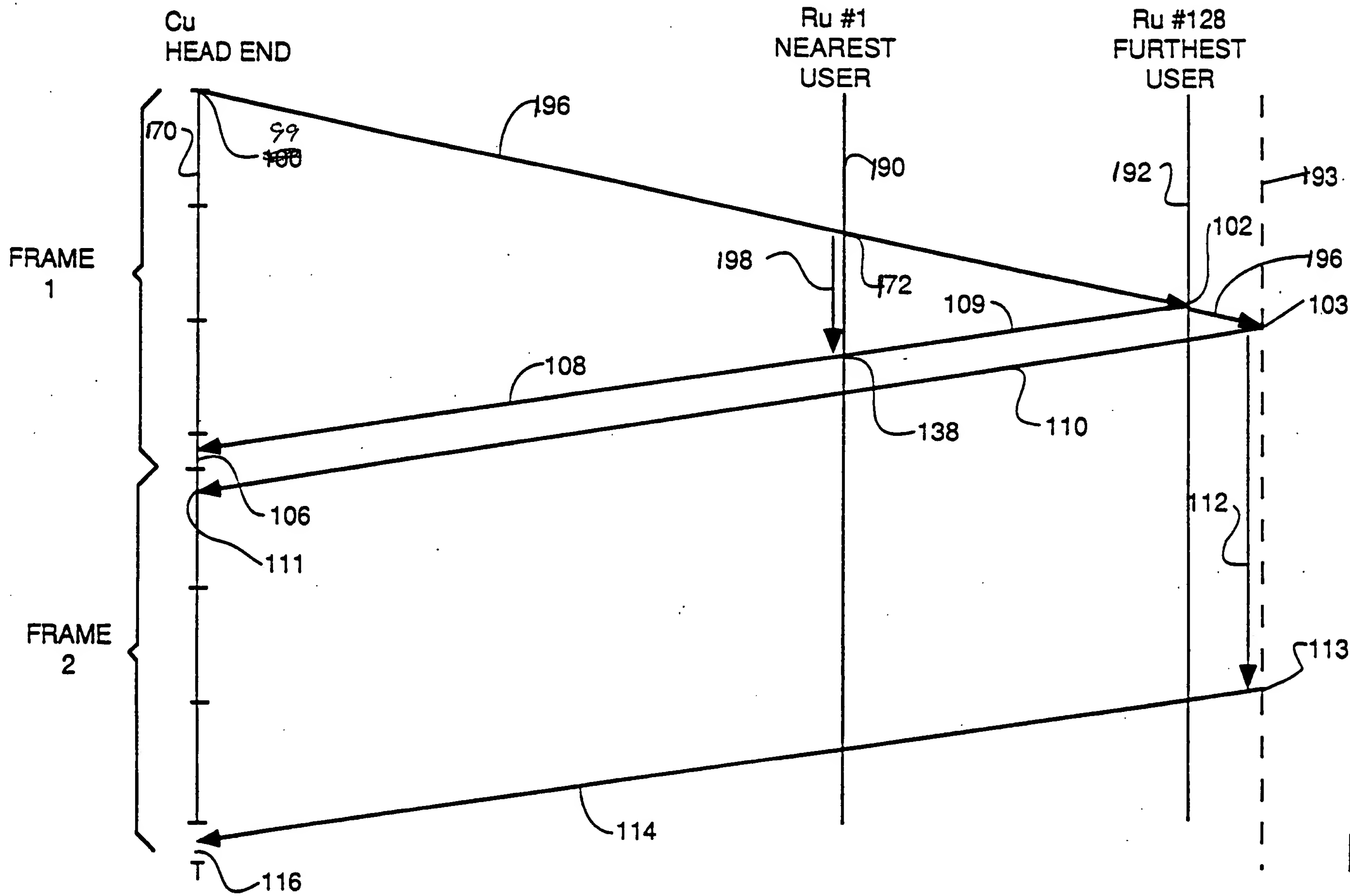

Cu
HEAD END
Ru #1
NEAREST
USER
Ru #128
FURTHEST
USER
FRAME
1
FRAME
2
170
99
~~100~~
196
190
192
193
102
196
103
198
172
109
108
138
110
106
111
112
113
114
116
T

FIG. ~~5~~ 3

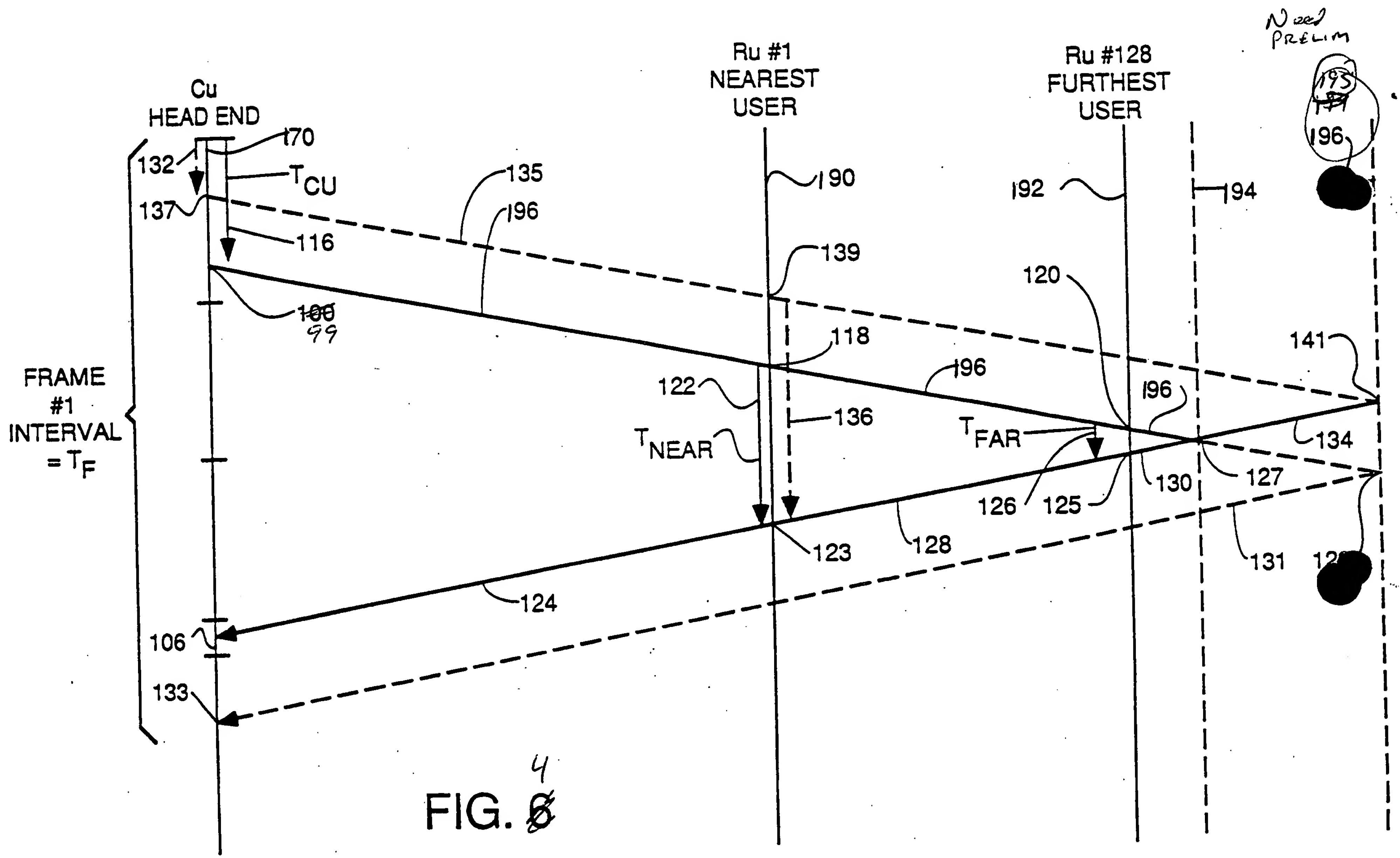
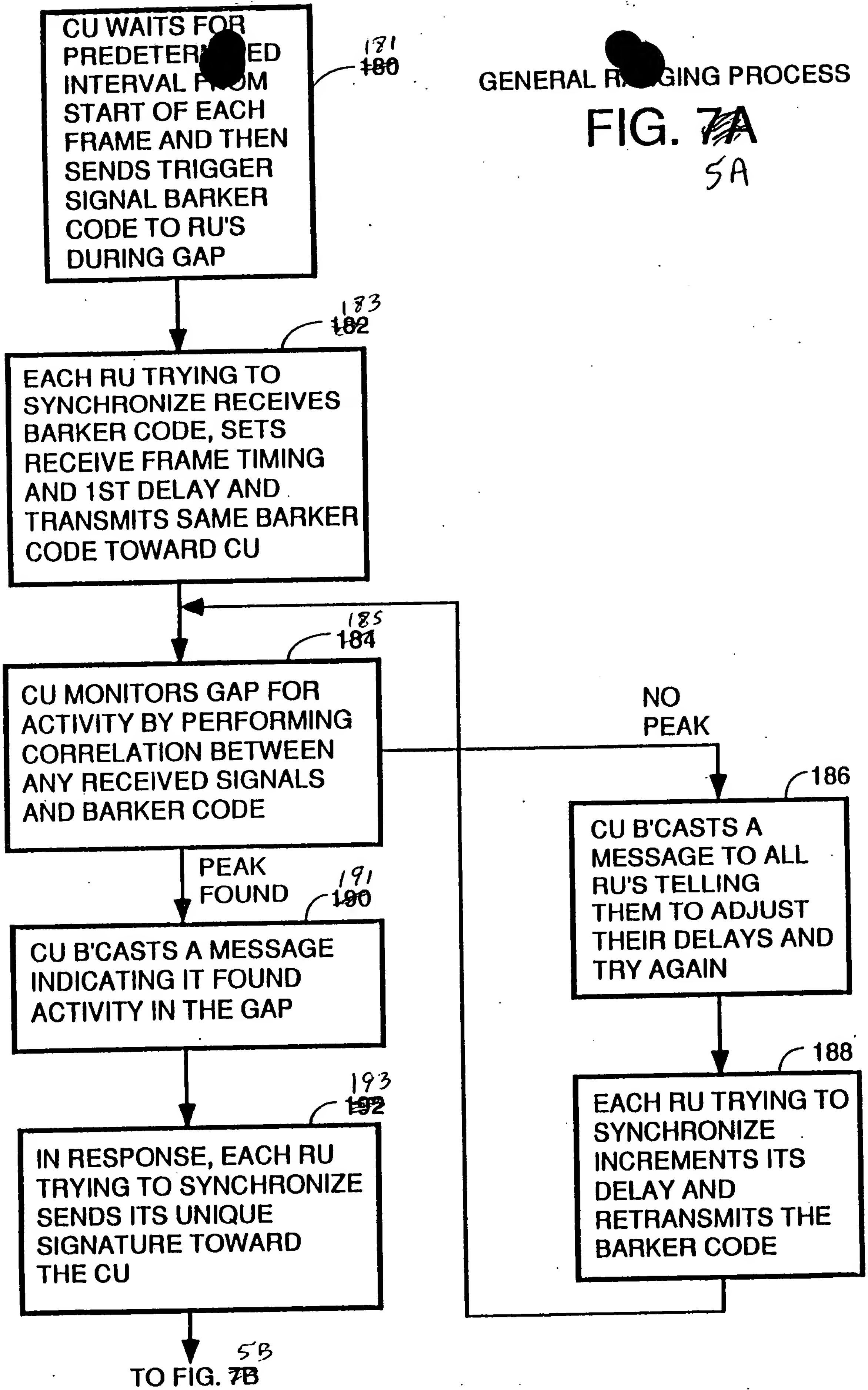
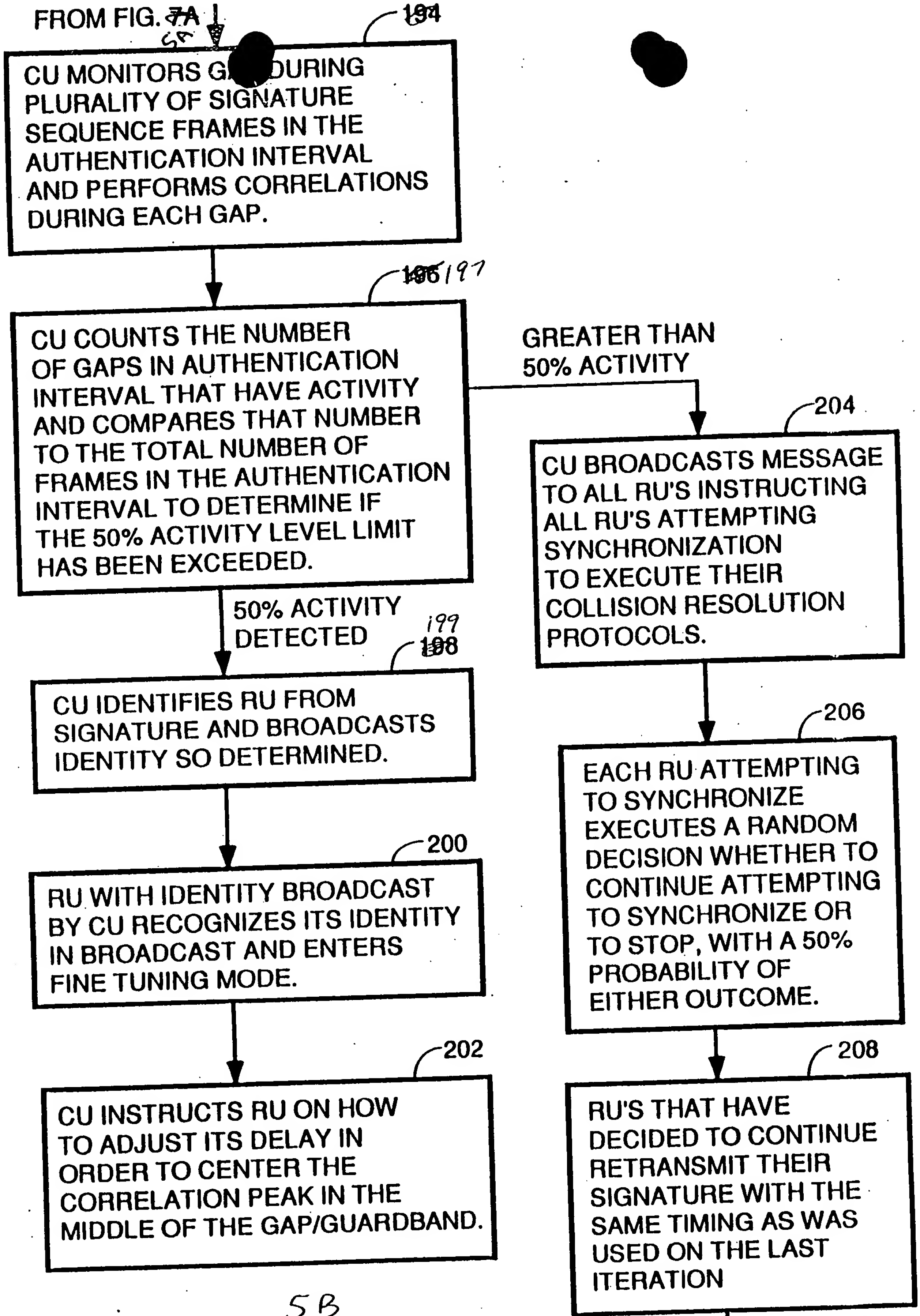

Need PRELIM
Cu
HEAD END
Ru #1
NEAREST
USER
Ru #128
FURTHEST
USER
FRAME
#1
INTERVAL
$= T_F$
T_{CU}
T_{NEAR}
T_{FAR}
170
132
137
116
~~100~~ 99
135
196
190
139
118
122
136
123
124
106
133
192
194
120
196
128
126
125
130
127
131
134
141
~~197~~ 195
196

FIG. ~~6~~ 4

GENERAL R GING PROCESS

FIG. ~~7A~~ 5A




FROM FIG. ~~7A~~ 5A
~~194~~
CU MONITORS G[illegible] DURING PLURALITY OF SIGNATURE SEQUENCE FRAMES IN THE AUTHENTICATION INTERVAL AND PERFORMS CORRELATIONS DURING EACH GAP.
~~196~~/197
CU COUNTS THE NUMBER OF GAPS IN AUTHENTICATION INTERVAL THAT HAVE ACTIVITY AND COMPARES THAT NUMBER TO THE TOTAL NUMBER OF FRAMES IN THE AUTHENTICATION INTERVAL TO DETERMINE IF THE 50% ACTIVITY LEVEL LIMIT HAS BEEN EXCEEDED.
GREATER THAN 50% ACTIVITY
204
CU BROADCASTS MESSAGE TO ALL RU'S INSTRUCTING ALL RU'S ATTEMPTING SYNCHRONIZATION TO EXECUTE THEIR COLLISION RESOLUTION PROTOCOLS.
50% ACTIVITY DETECTED
199
~~198~~
CU IDENTIFIES RU FROM SIGNATURE AND BROADCASTS IDENTITY SO DETERMINED.
206
EACH RU ATTEMPTING TO SYNCHRONIZE EXECUTES A RANDOM DECISION WHETHER TO CONTINUE ATTEMPTING TO SYNCHRONIZE OR TO STOP, WITH A 50% PROBABILITY OF EITHER OUTCOME.
200
RU WITH IDENTITY BROADCAST BY CU RECOGNIZES ITS IDENTITY IN BROADCAST AND ENTERS FINE TUNING MODE.
202
CU INSTRUCTS RU ON HOW TO ADJUST ITS DELAY IN ORDER TO CENTER THE CORRELATION PEAK IN THE MIDDLE OF THE GAP/GUARDBAND.
208
RU'S THAT HAVE DECIDED TO CONTINUE RETRANSMIT THEIR SIGNATURE WITH THE SAME TIMING AS WAS USED ON THE LAST ITERATION
TO FIG. ~~7C~~ 5C

5B

FIG. ~~7B~~

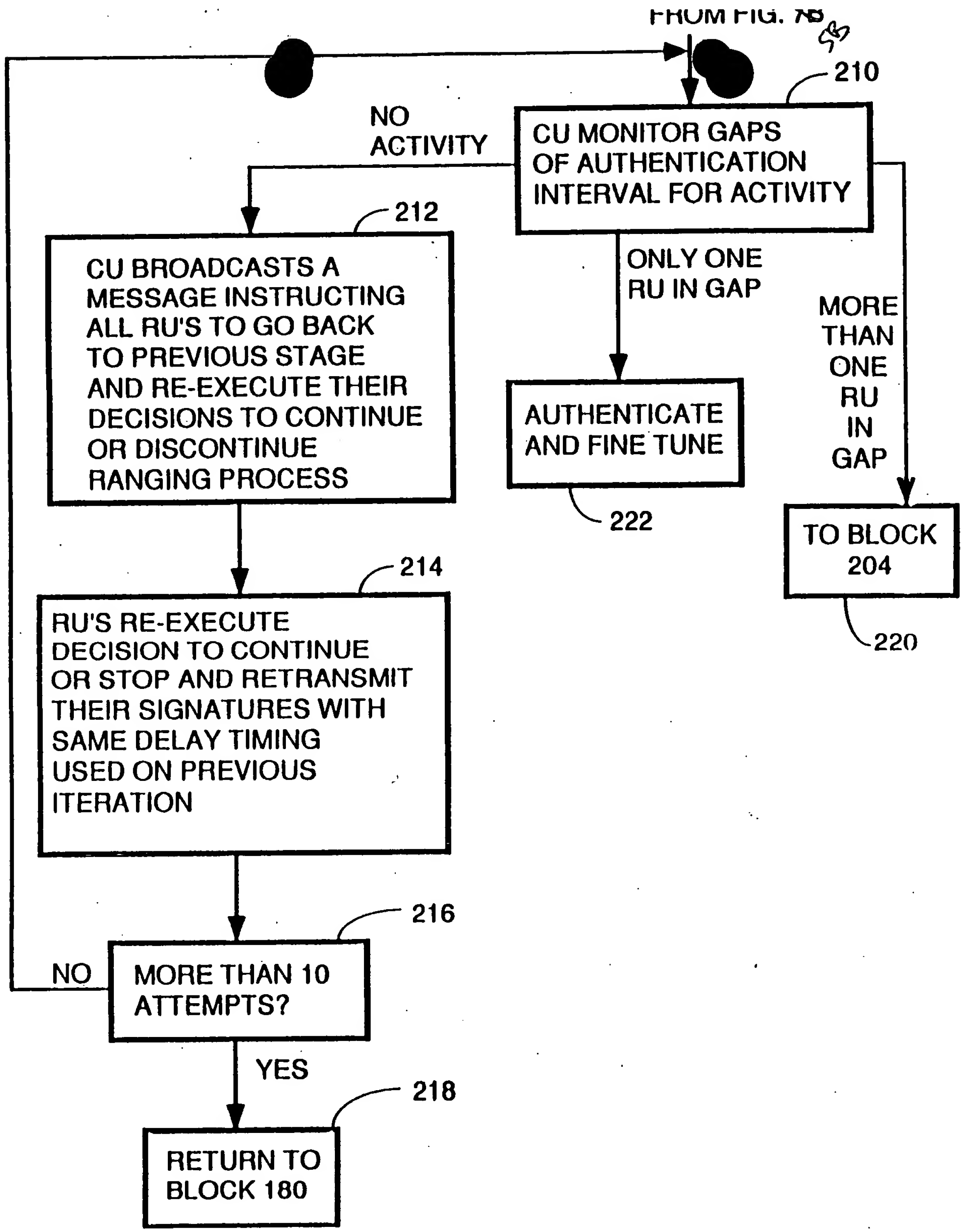
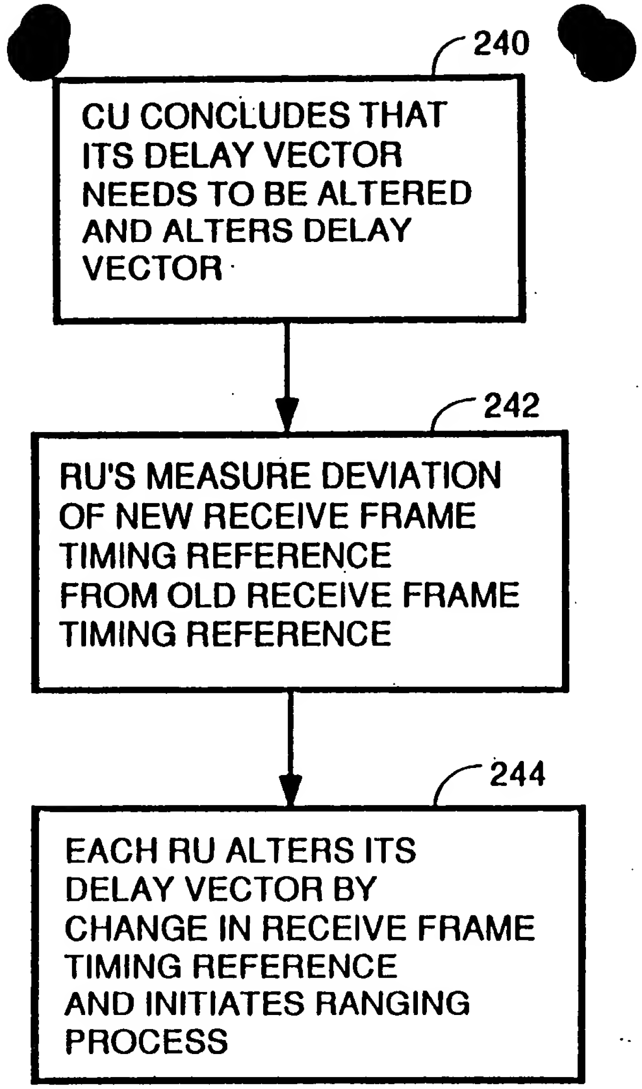

FROM FIG. ~~7B~~ 5B
210
CU MONITOR GAPS OF AUTHENTICATION INTERVAL FOR ACTIVITY
NO ACTIVITY
212
CU BROADCASTS A MESSAGE INSTRUCTING ALL RU'S TO GO BACK TO PREVIOUS STAGE AND RE-EXECUTE THEIR DECISIONS TO CONTINUE OR DISCONTINUE RANGING PROCESS
ONLY ONE RU IN GAP
AUTHENTICATE AND FINE TUNE
222
MORE THAN ONE RU IN GAP
TO BLOCK 204
220
214
RU'S RE-EXECUTE DECISION TO CONTINUE OR STOP AND RETRANSMIT THEIR SIGNATURES WITH SAME DELAY TIMING USED ON PREVIOUS ITERATION
216
NO
MORE THAN 10 ATTEMPTS?
YES
218
RETURN TO BLOCK 180

FIG. ~~7C~~ 5C



6
FIG. ~~8~~

DEAD RECKONING RE-SYNC

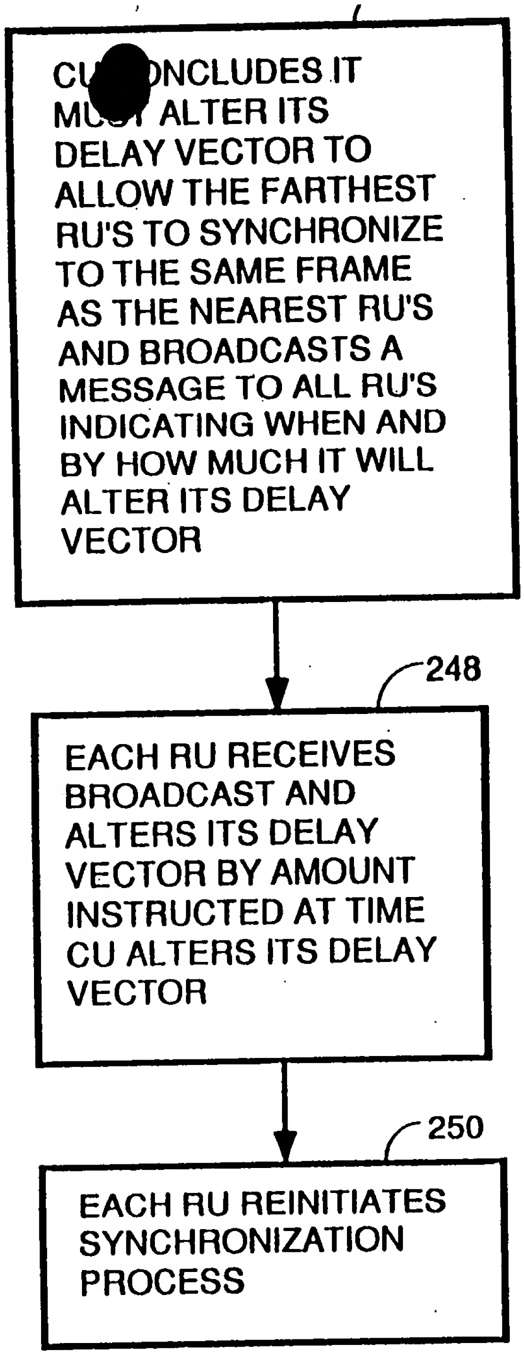
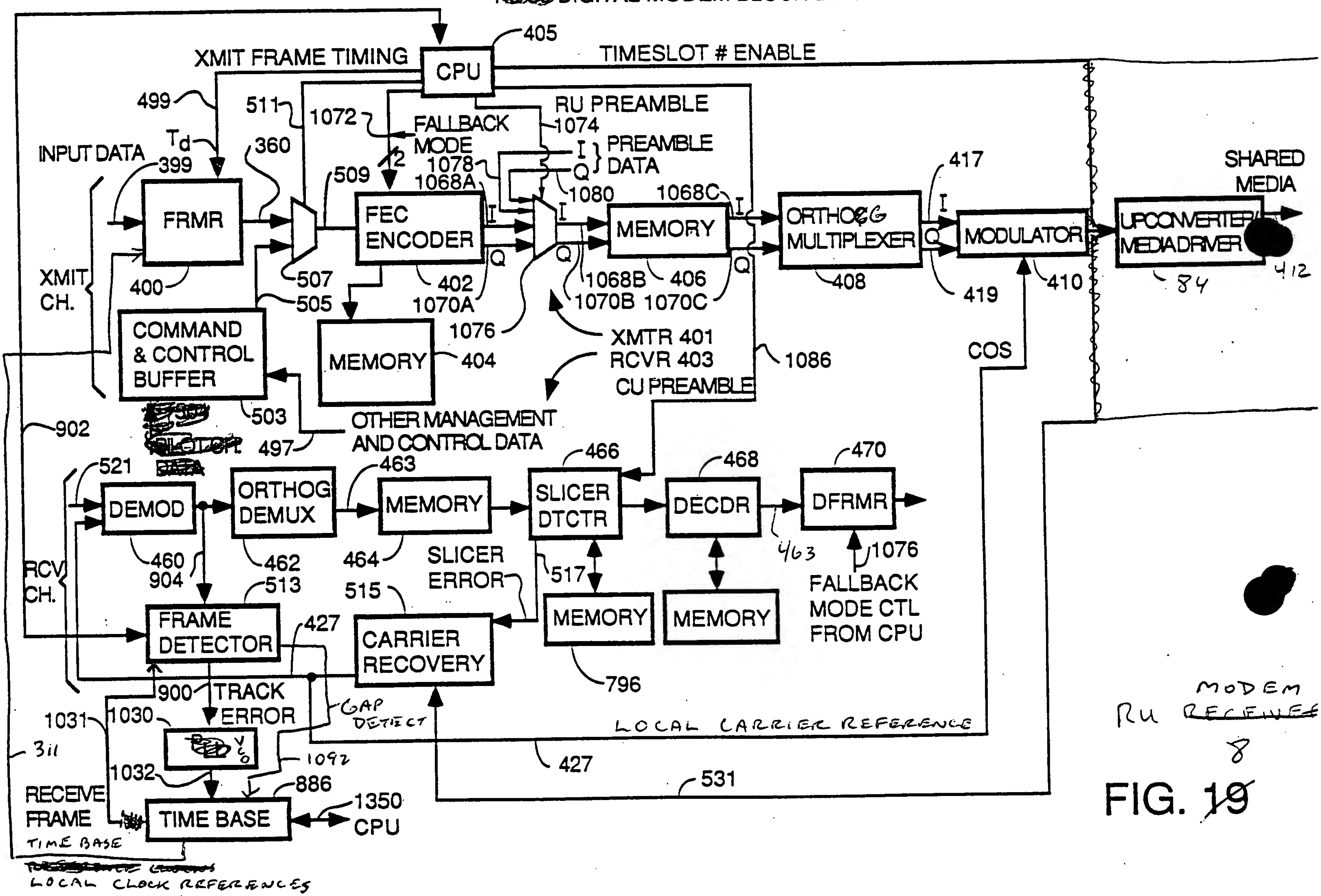


FIG. ~~9~~ 7
PRECURSOR EMBODIMENT

RU DIGITAL MODEM BLOCK DIAGRAM



MODEM
RU ~~RECEIVER~~

8

FIG. ~~19~~

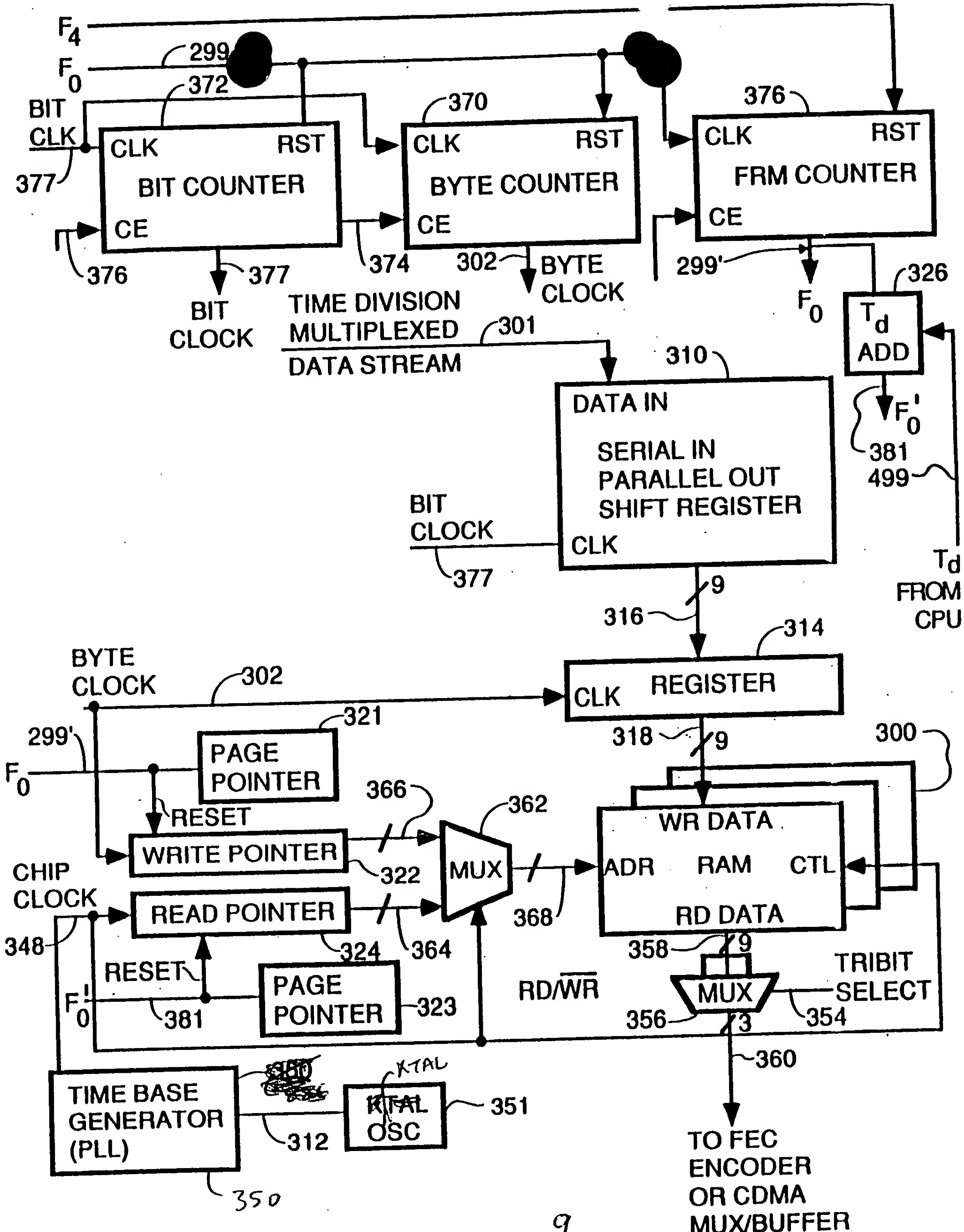

F4
F0
299
372
BIT CLK
377
CLK
RST
BIT COUNTER
CE
376
377
BIT CLOCK
370
CLK
RST
BYTE COUNTER
CE
374
302
BYTE CLOCK
376
CLK
RST
FRM COUNTER
CE
299'
F0
326
Td ADD
F0'
381
499
Td FROM CPU
TIME DIVISION MULTIPLEXED DATA STREAM
301
310
DATA IN
SERIAL IN PARALLEL OUT SHIFT REGISTER
CLK
BIT CLOCK
377
9
316
314
CLK
REGISTER
BYTE CLOCK
302
321
PAGE POINTER
299'
F0
RESET
318
9
300
366
362
WRITE POINTER
322
MUX
368
WR DATA
ADR
RAM
CTL
RD DATA
CHIP CLOCK
348
READ POINTER
324
364
RESET
PAGE POINTER
323
F0'
381
RD/WR
358
9
MUX
TRIBIT SELECT
356
354
3
360
TO FEC ENCODER OR CDMA MUX/BUFFER
TIME BASE GENERATOR (PLL)
350
312
XTAL
OSC
351

FIG. ~~12~~ 9

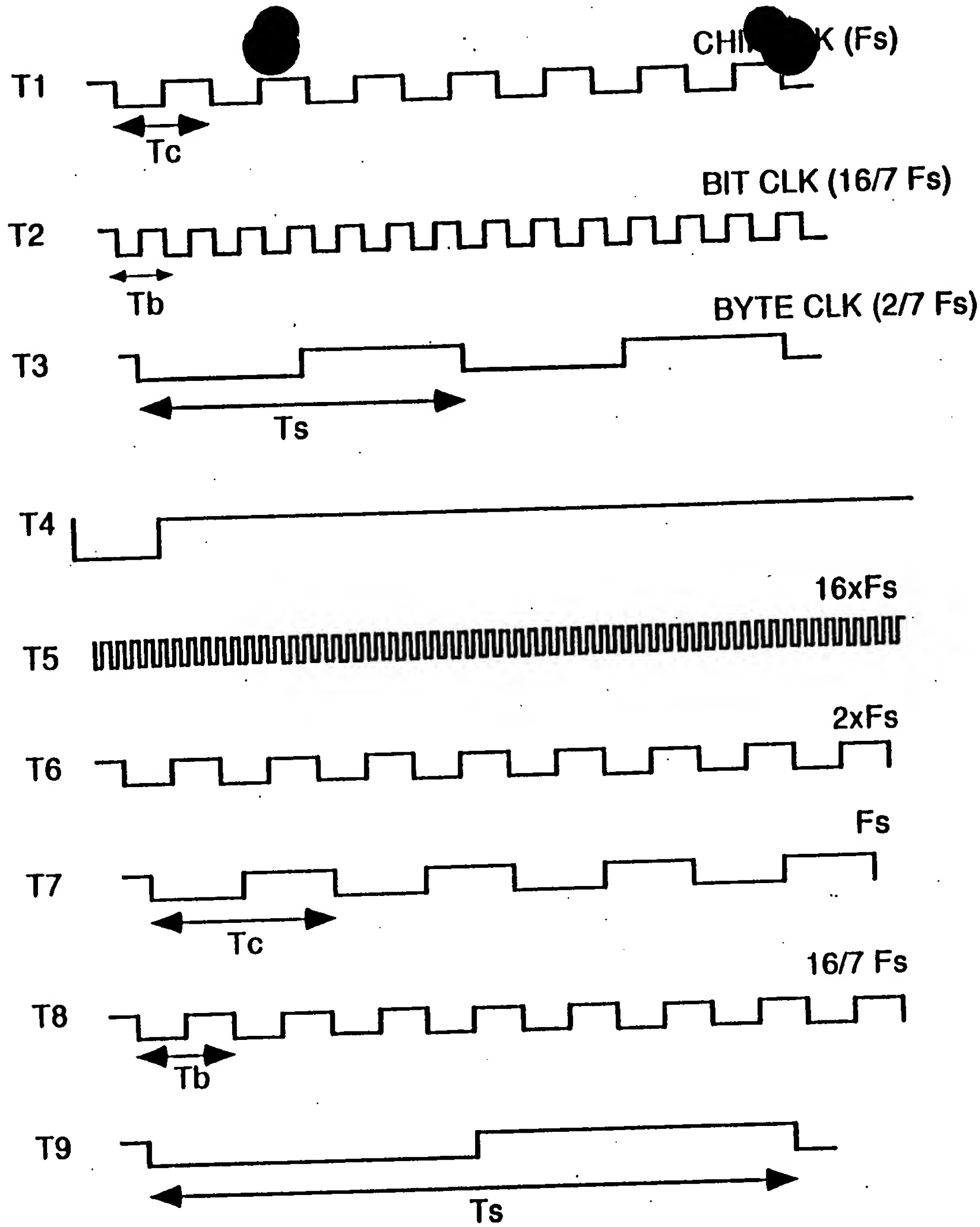

CHI K (Fs)
T1
Tc
BIT CLK (16/7 Fs)
T2
Tb
BYTE CLK (2/7 Fs)
T3
Ts
T4
16xFs
T5
2xFs
T6
Fs
T7
Tc
16/7 Fs
T8
Tb
T9
Ts

FIG. ~~13~~ 10

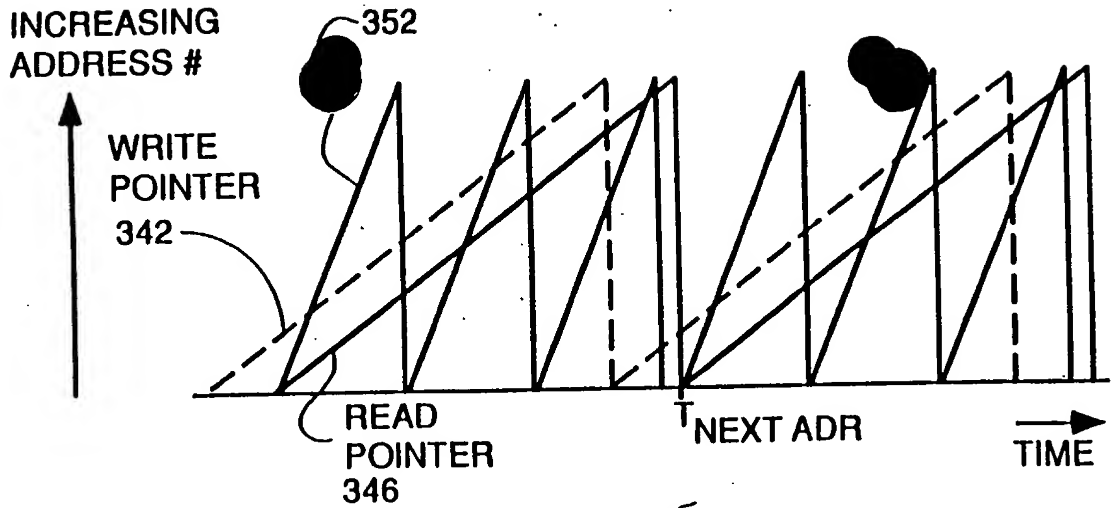


FIG. ~~17~~ 15

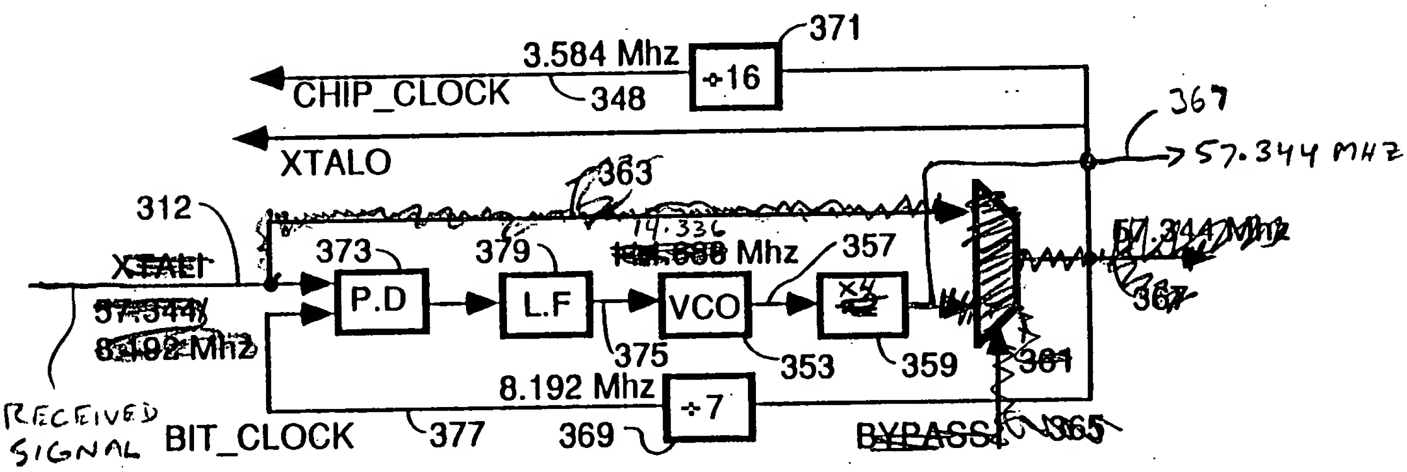


FIG. ~~18~~ 11

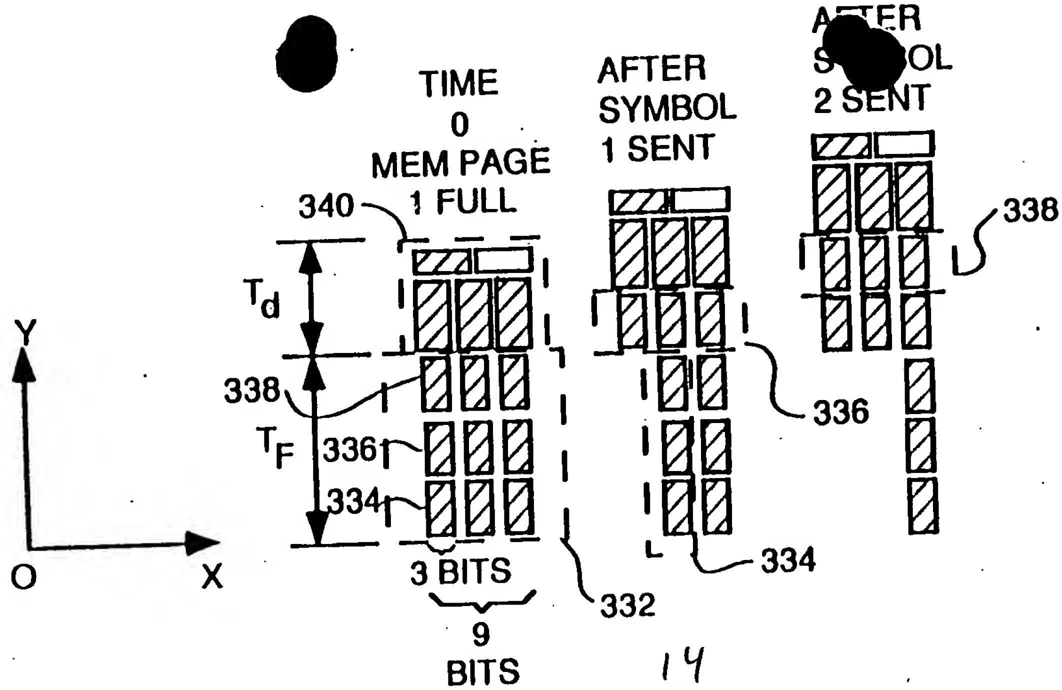


FIG. ~~14~~ 14 ok

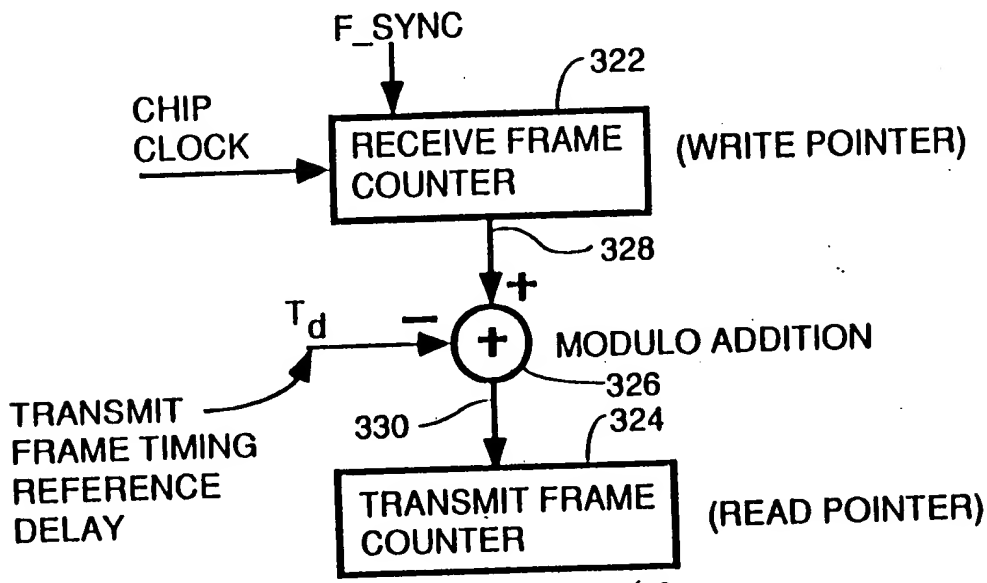


FIG. ~~15~~ 12

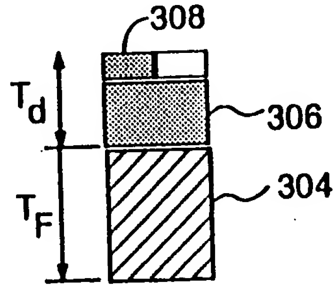


FIG. ~~16~~ 13

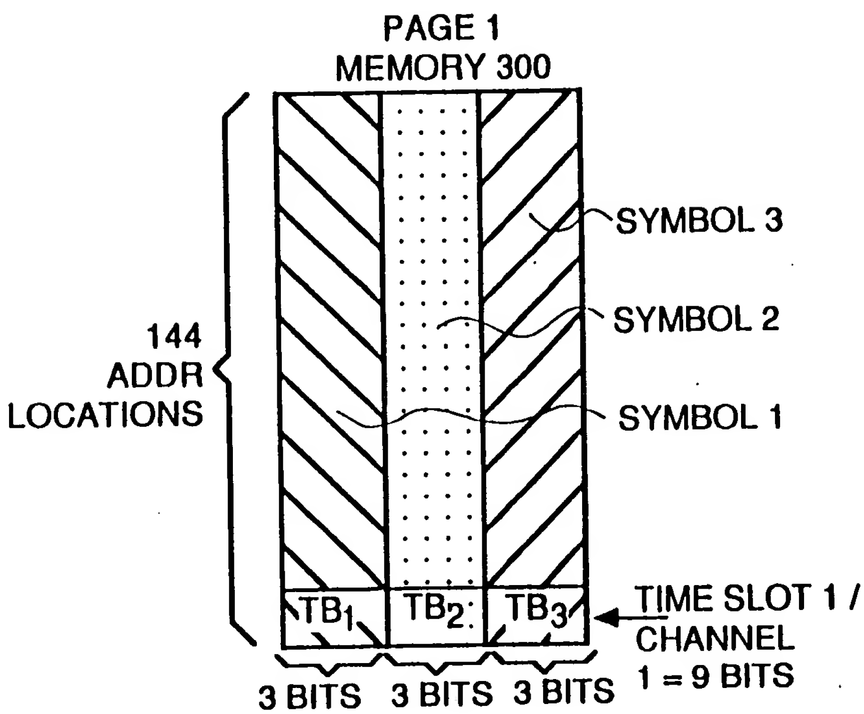
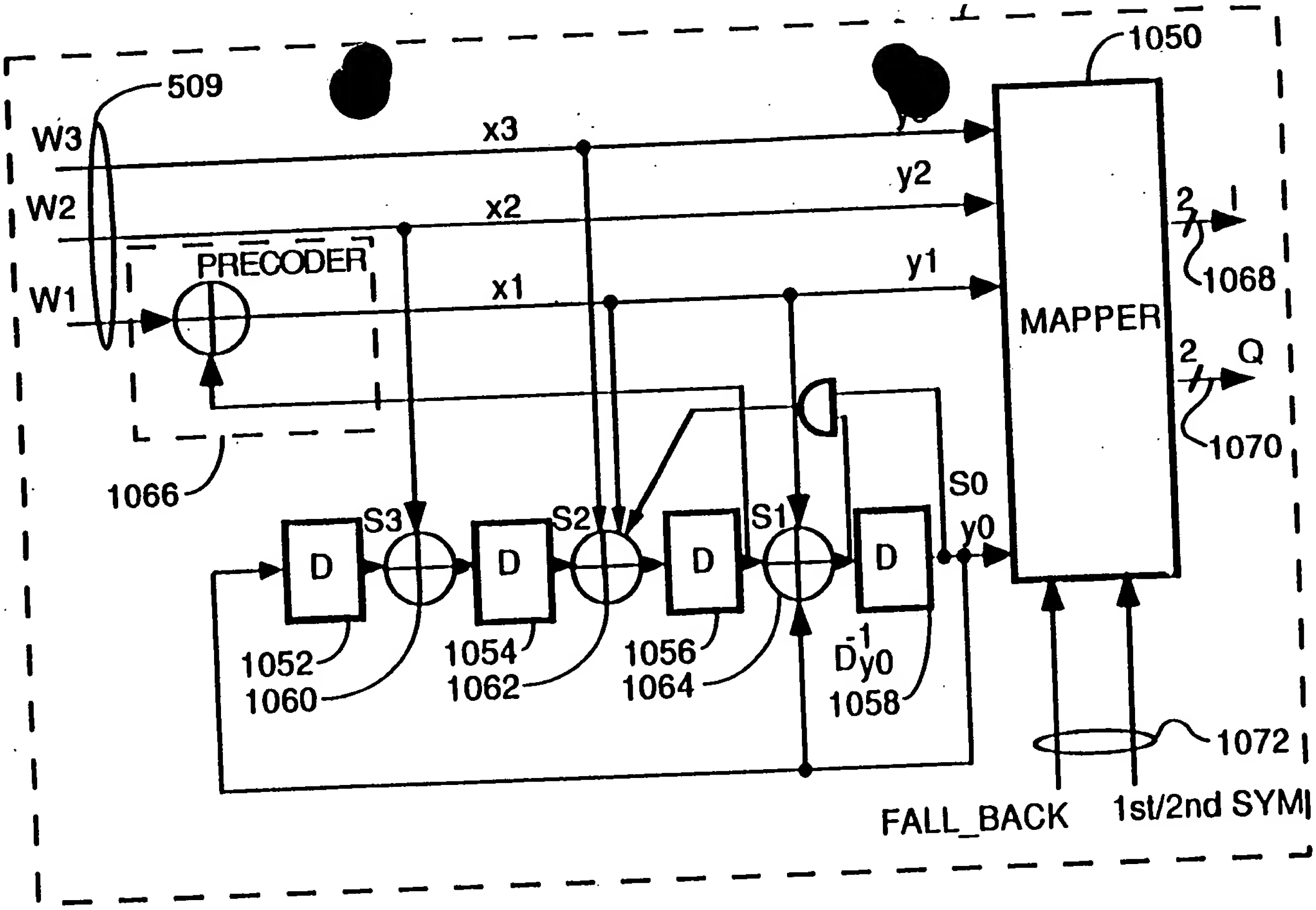

PAGE 1
MEMORY 300
144
ADDR
LOCATIONS
SYMBOL 3
SYMBOL 2
SYMBOL 1
TB_1
TB_2
TB_3
TIME SLOT 1 /
CHANNEL
1 = 9 BITS
3 BITS
3 BITS
3 BITS

FIG. ~~20~~ 16



PREFERRED TRELLIS ENCODER

FIG. ~~42~~ 17

MAPPING FOR FALL-BACK MODE - LSB'S

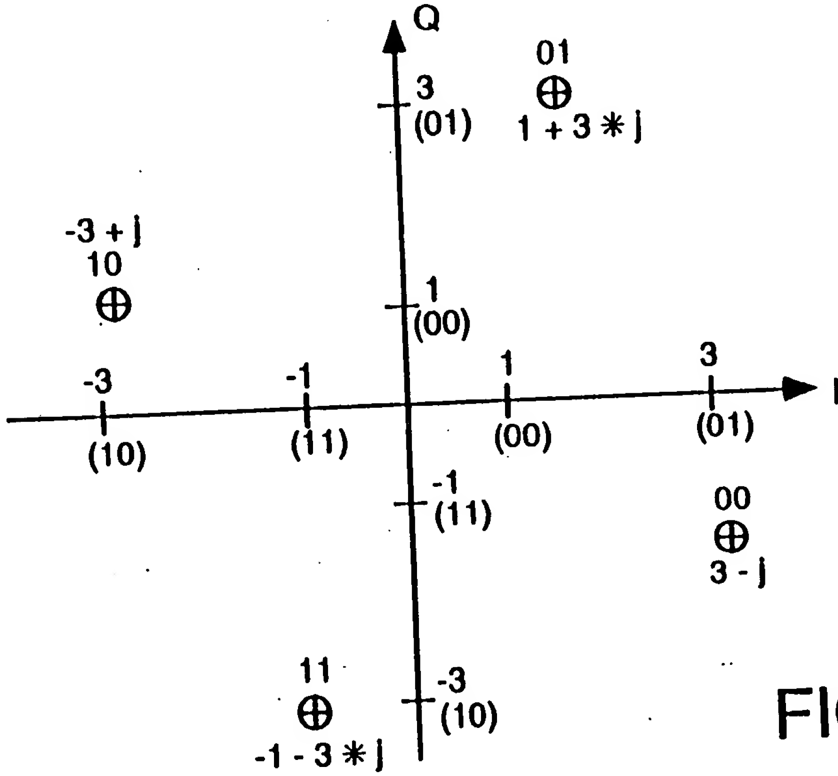


FIG. ~~43~~ 21

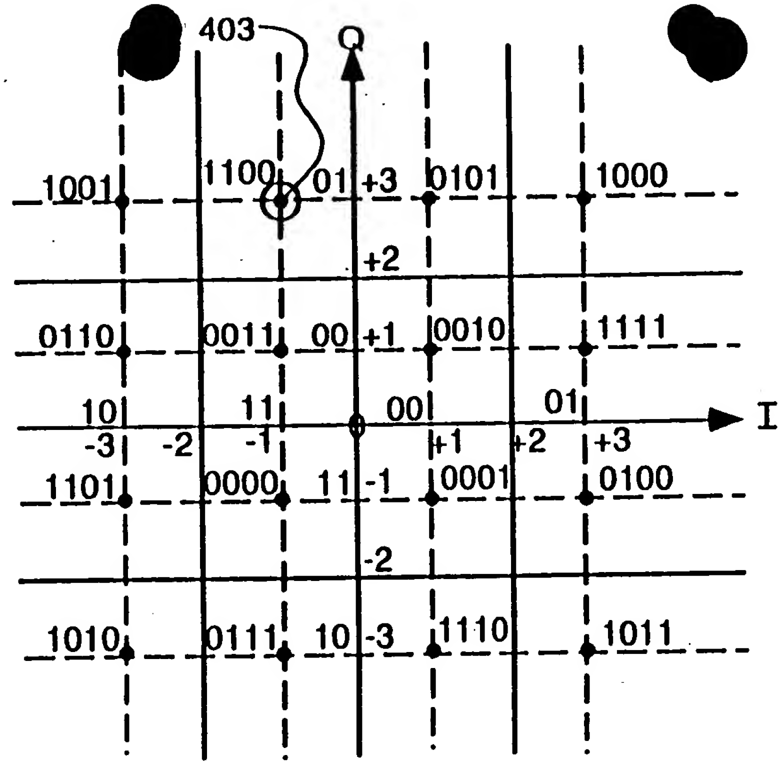
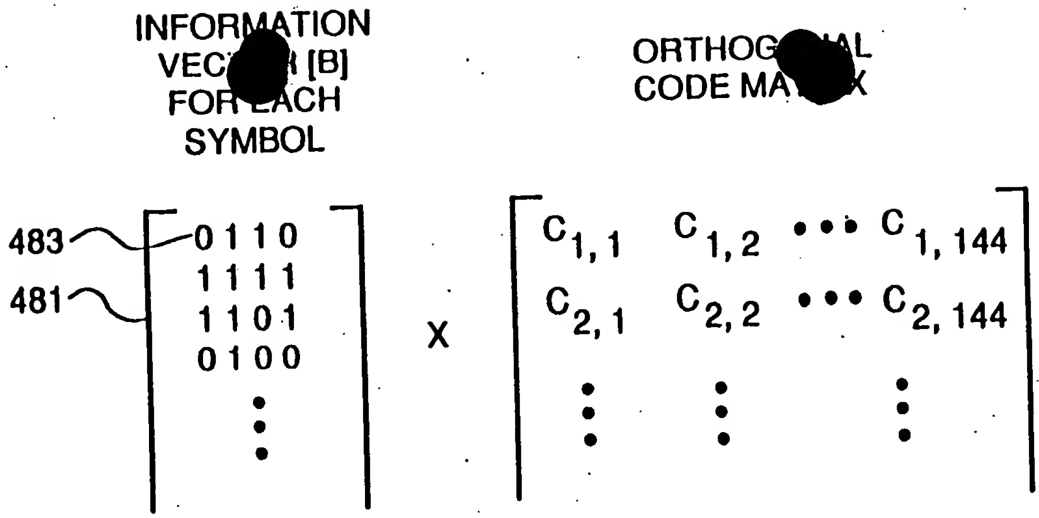


FIG. ~~21~~ 18

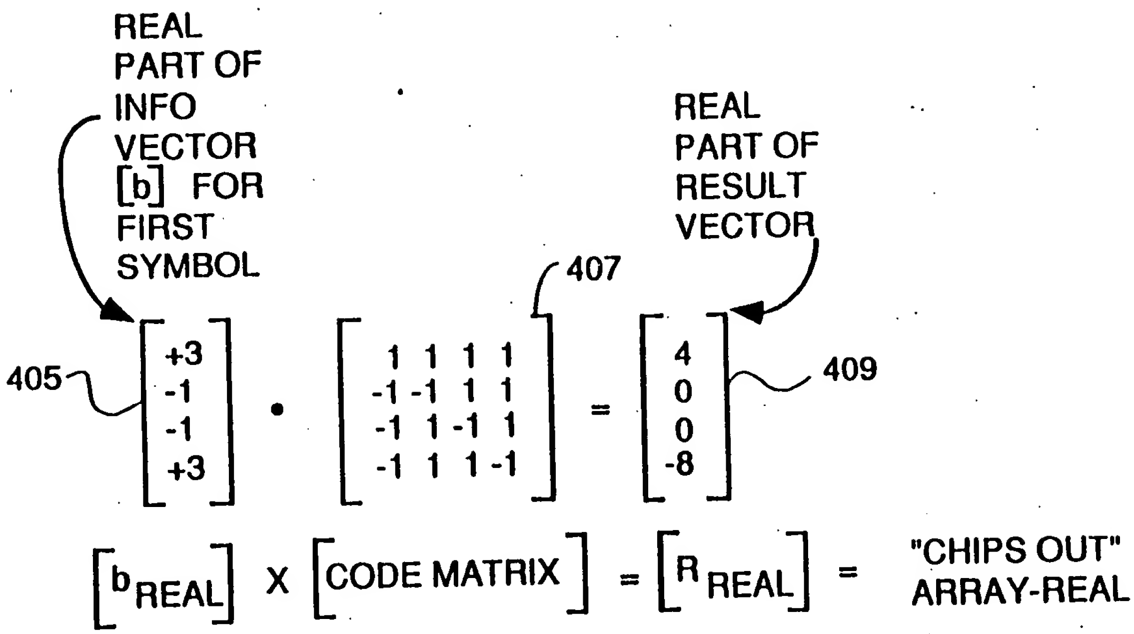
	CODE	INPHASE	QUADRATURE	
	0000	111	111	= -1 -
	0001	001	111	= 1 - j
	0010	001	001	= 1+ j
	0011	111	001	= -1+ j
	0100	011	111	= 3 - j
	0101	001	011	= 1+ 3∗j
	0110	101	001	= -3 + j
	0111	111	101	= -1 - 3∗j
	1000	011	011	=+3 + 3∗j
	1001	101	011	= -3 + 3∗j
	1010	101	101	= -3 - 3∗j
	1011	011	101	= 3 - 3∗j
403	1100	111	011	= -1+ 3∗j
	1101	101	111	= -3 - j
	1110	001	101	= 1 - 3∗j
	1111	011	001	= 3 + j

FIG. ~~22~~ 19



20 A

FIG. ~~23~~A



20B

FIG. ~~23~~B

LSBs y1 y0	PHASE	1+jQ
00	0	3-j
01	90	1+j3
10	180	-3+j
11	-90	-1-j3

MSBs y3 y2	PHASE difference (2nd-1st symbol)	1+jQ WHEN LSB=00	1+jQ WHEN LSB=01	1+jQ WHEN LSB=10	1+jQ WHEN LSB=11
00	0	3-j	1+j3	-3+j	-1-j3
01	90	1+j3	-3+j	-1-j3	3-j
10	180	-3+j	-1-j3	3-j	1+j3
11	-90	-1-j3	3-j	1+j3	-3+j

LSB & MSB FALLBACK MODE MAPPINGS

FIG. ~~44~~ 22

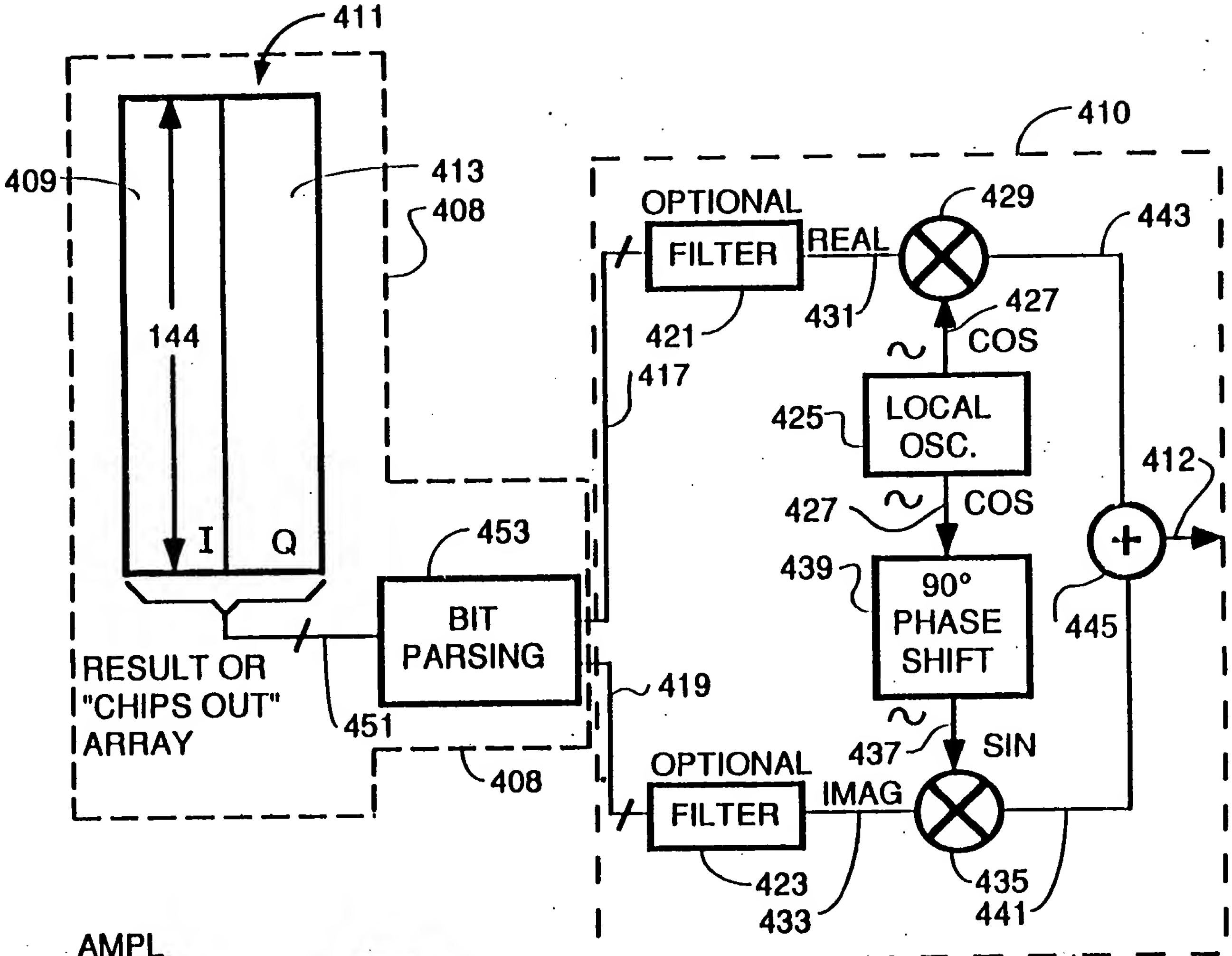


FIG. ~~24~~ 23

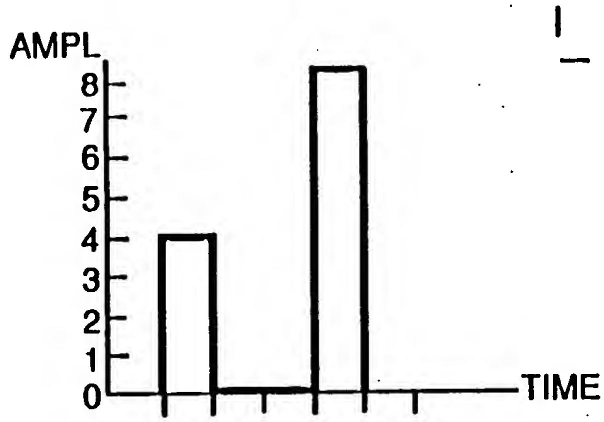
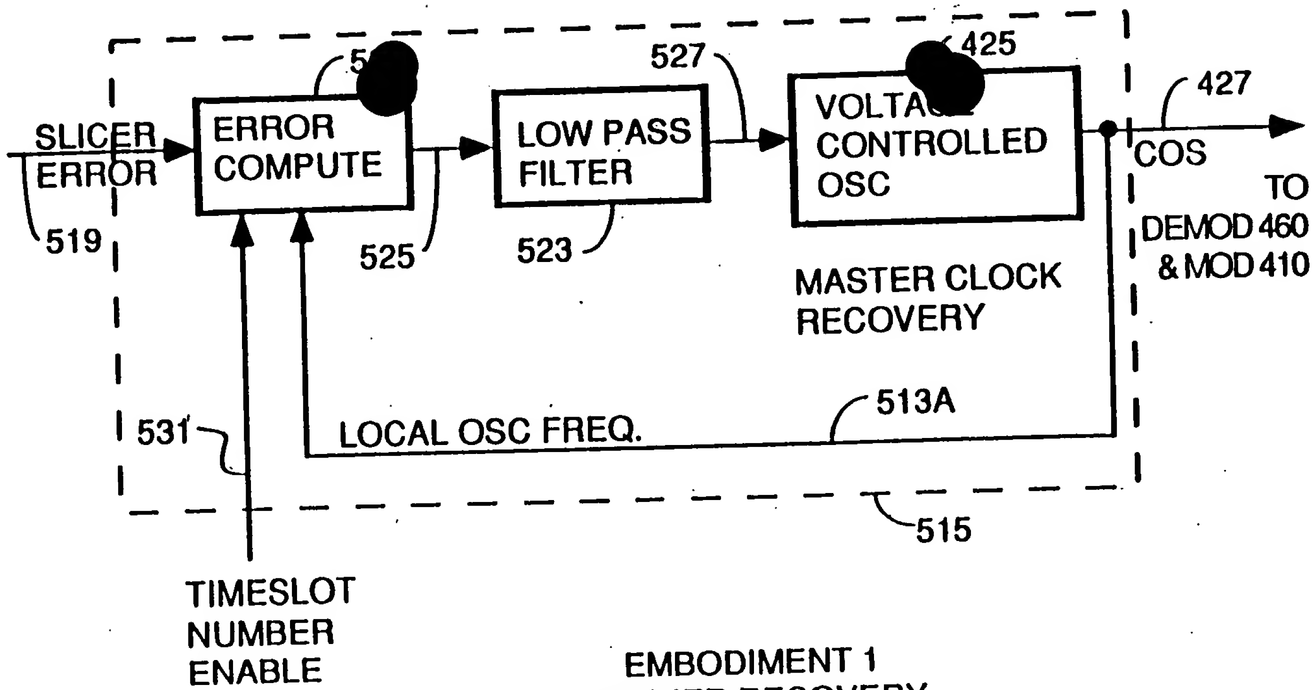
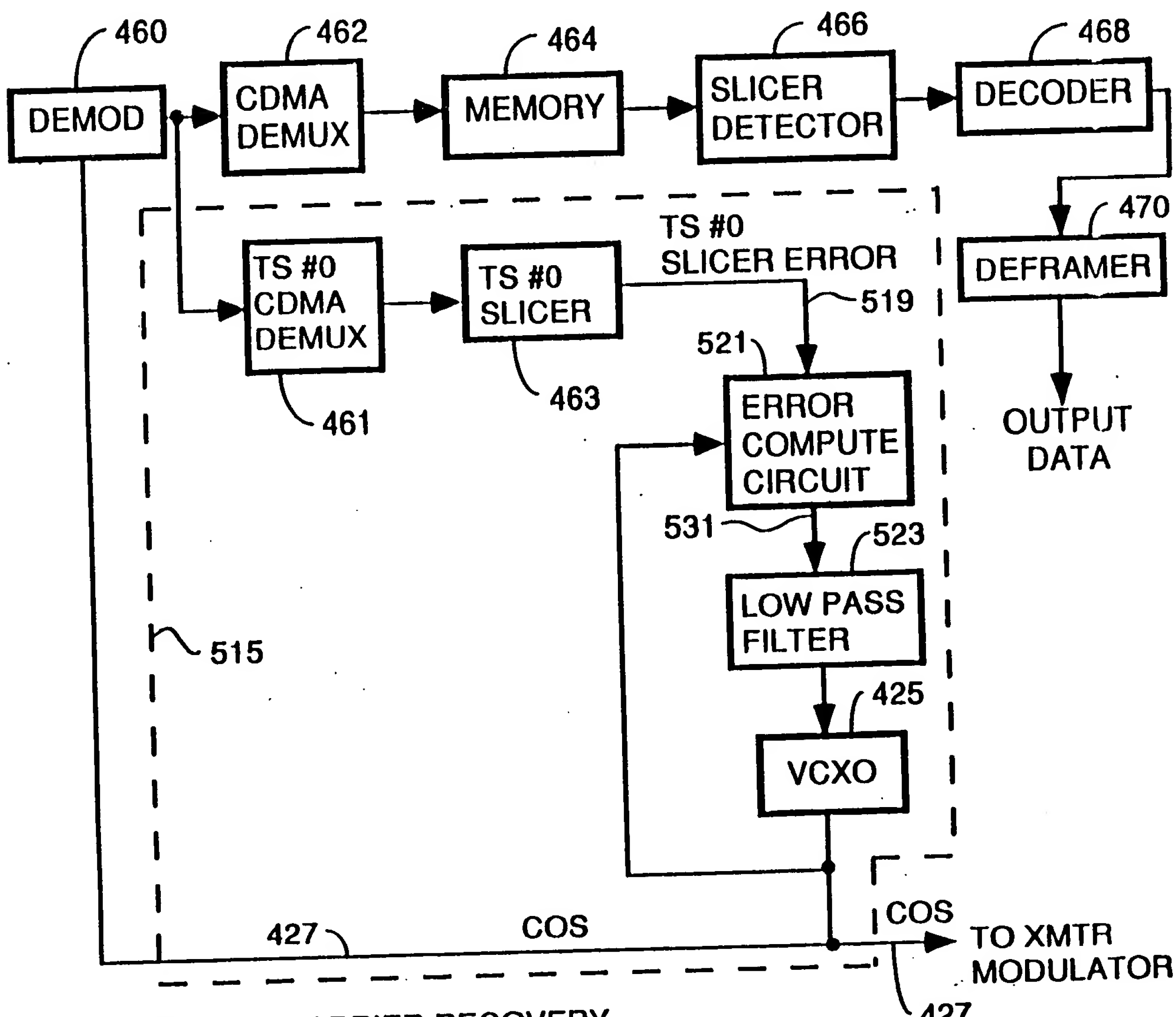


FIG. ~~25~~ 24



EMBODIMENT 1
CARRIER RECOVERY

FIG. ~~35~~ 25



EMBODIMENT 2 CARRIER RECOVERY

FIG. ~~36~~ 26

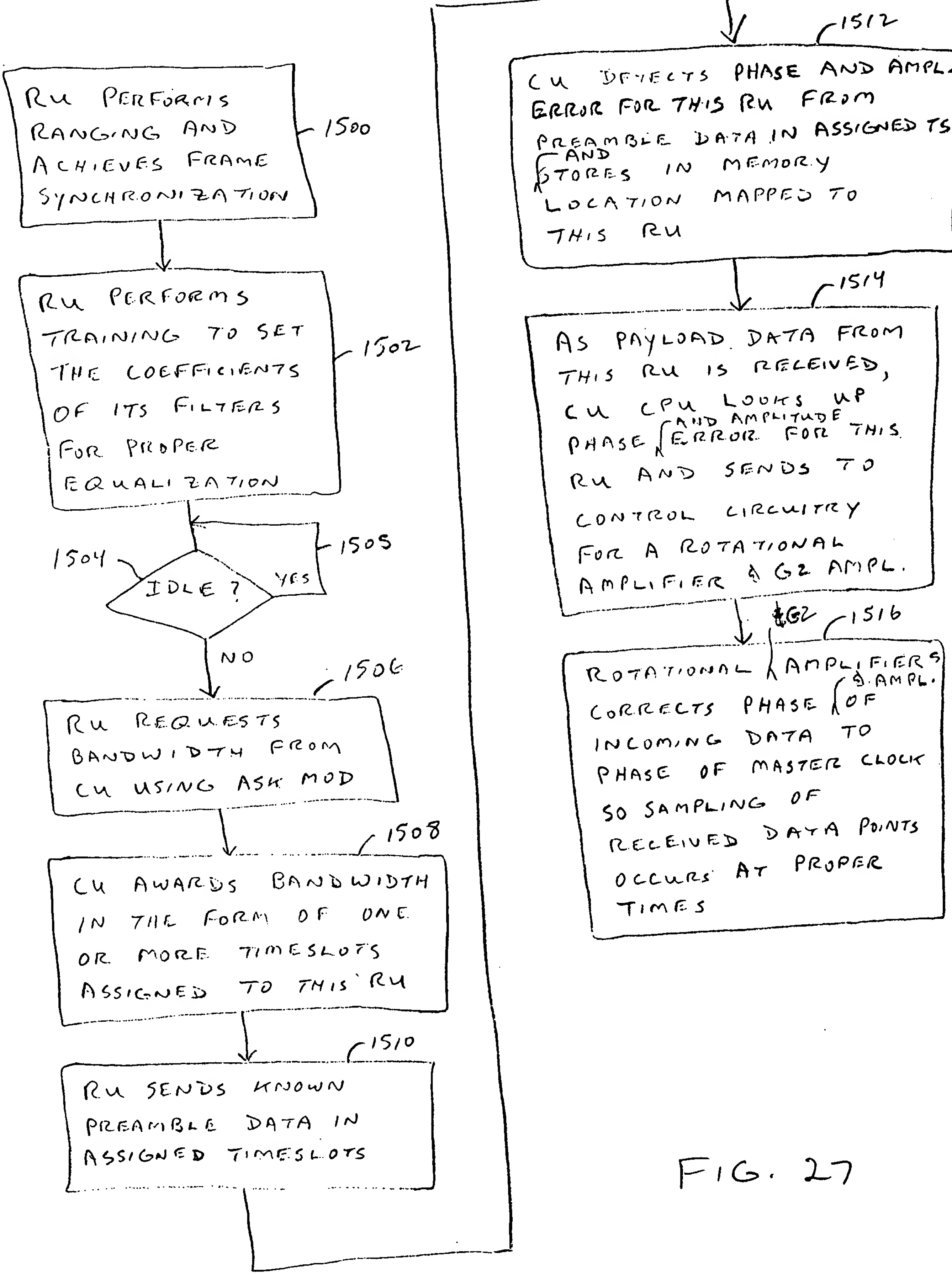
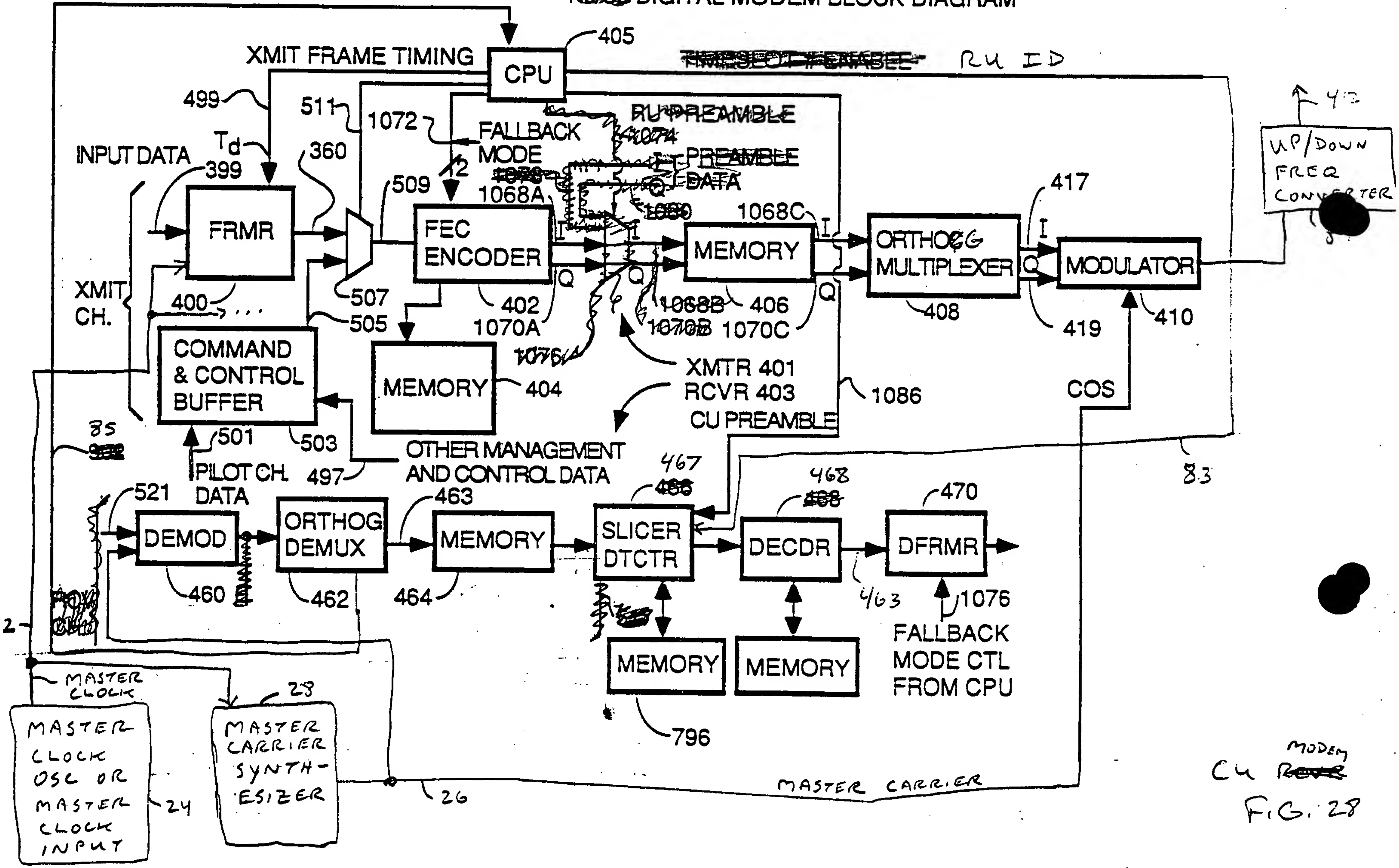

RU PERFORMS RANGING AND ACHIEVES FRAME SYNCHRONIZATION
1500
RU PERFORMS TRAINING TO SET THE COEFFICIENTS OF ITS FILTERS FOR PROPER EQUALIZATION
1502
1504
IDLE ?
YES
1505
NO
1506
RU REQUESTS BANDWIDTH FROM CU USING ASK MOD
1508
CU AWARDS BANDWIDTH IN THE FORM OF ONE OR MORE TIMESLOTS ASSIGNED TO THIS RU
1510
RU SENDS KNOWN PREAMBLE DATA IN ASSIGNED TIMESLOTS
1512
CU DETECTS PHASE AND AMPL. ERROR FOR THIS RU FROM PREAMBLE DATA IN ASSIGNED TS AND STORES IN MEMORY LOCATION MAPPED TO THIS RU
1514
AS PAYLOAD DATA FROM THIS RU IS RECEIVED, CU CPU LOOKS UP PHASE AND AMPLITUDE ERROR FOR THIS RU AND SENDS TO CONTROL CIRCUITRY FOR A ROTATIONAL AMPLIFIER & G2 AMPL.
& G2
1516
ROTATIONAL AMPLIFIERS CORRECTS PHASE & AMPL. OF INCOMING DATA TO PHASE OF MASTER CLOCK SO SAMPLING OF RECEIVED DATA POINTS OCCURS AT PROPER TIMES

FIG. 27

CU

DIGITAL MODEM BLOCK DIAGRAM



CU MODEM

FIG. 28

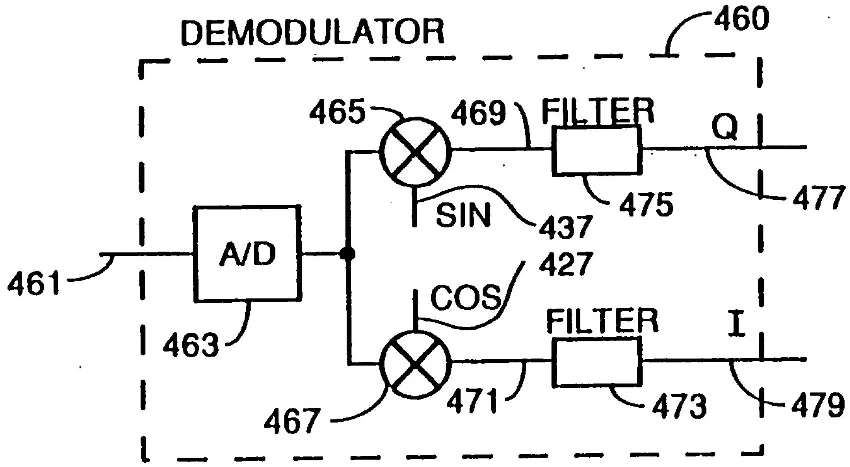

DEMODULATOR
460
465
469
FILTER
Q
477
475
SIN
437
A/D
461
463
427
COS
FILTER
I
467
471
473
479

FIG. ~~26~~ 29

Page 94, Line 8 Removed ref to 793

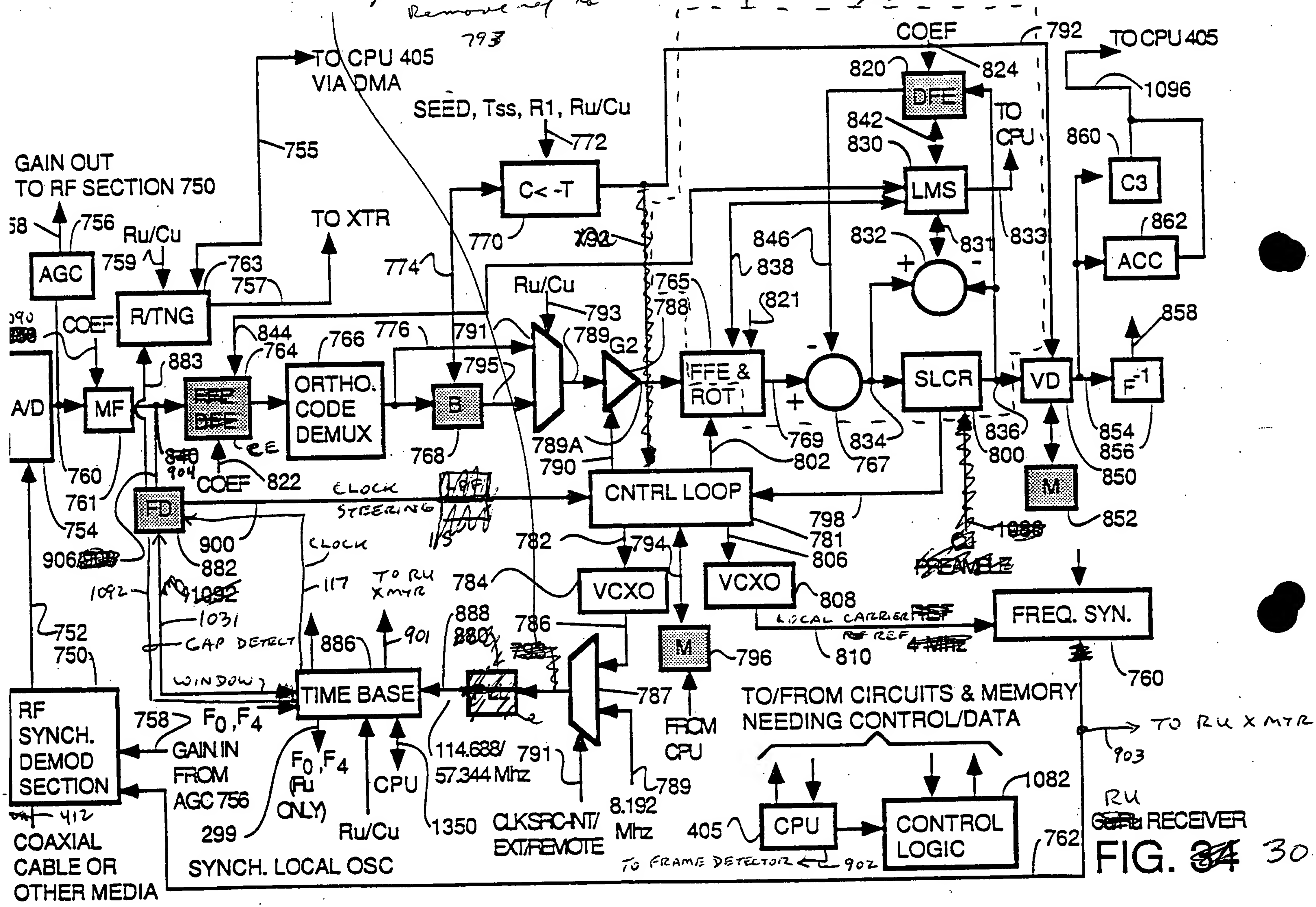


FIG. ~~34~~ 30

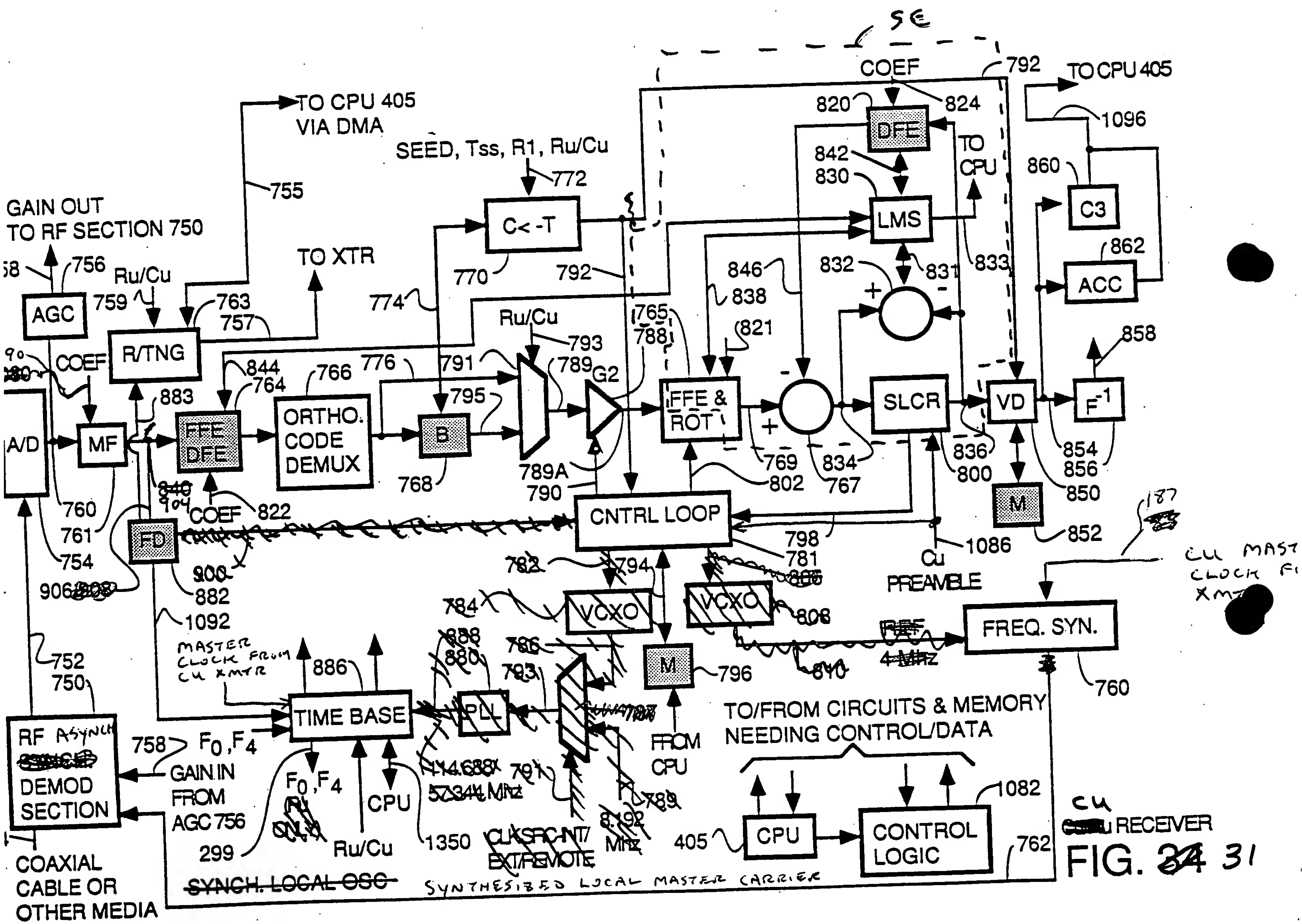
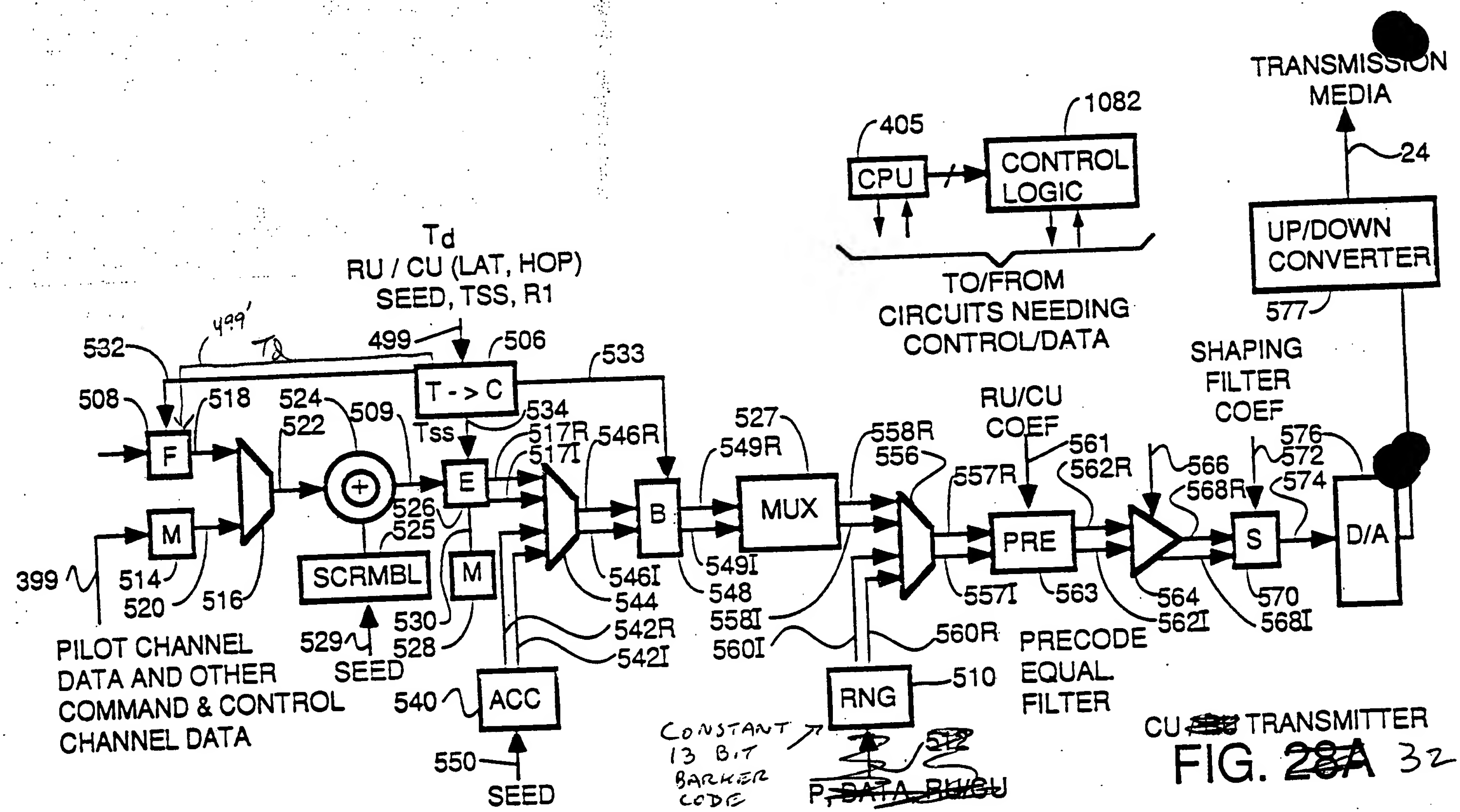

SE
COEF
TO CPU 405
TO CPU 405
VIA DMA
SEED, Tss, R1, Ru/Cu
GAIN OUT
TO RF SECTION 750
TO XTR
AGC
R/TNG
Ru/Cu
C<-T
DFE
LMS
TO CPU
C3
ACC
F^{-1}
A/D
MF
FFE DFE
ORTHO. CODE DEMUX
B
G2
FFE & ROT
SLCR
VD
M
CNTRL LOOP
FD
VCXO
VCXO
M
FREQ. SYN.
Cu PREAMBLE
MASTER CLOCK FROM CU XMTR
TIME BASE
PLL
FROM CPU
TO/FROM CIRCUITS & MEMORY NEEDING CONTROL/DATA
CPU
CONTROL LOGIC
RF ASYNCH DEMOD SECTION
GAIN IN FROM AGC 756
F_0, F_4
CPU
Ru/Cu
CLKSRC INT/EXT/REMOTE
8.192 MHz
COAXIAL CABLE OR OTHER MEDIA
~~SYNCH. LOCAL OSC~~
SYNTHESIZED LOCAL MASTER CARRIER
CU MASTER CLOCK FROM XMTR
4 MHz
CU RECEIVER

FIG. ~~24~~ 31

10311101 062115260



CU ~~28~~ TRANSMITTER
FIG. ~~28A~~ 32

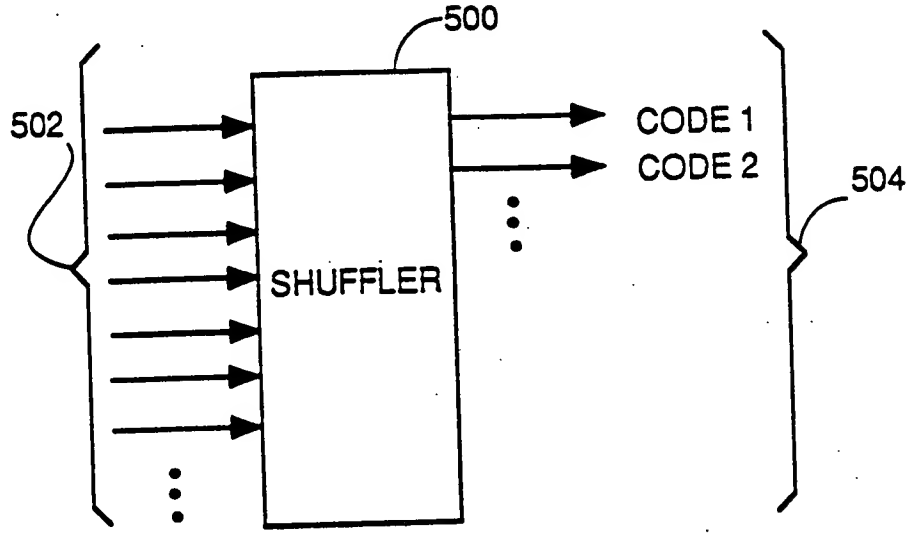
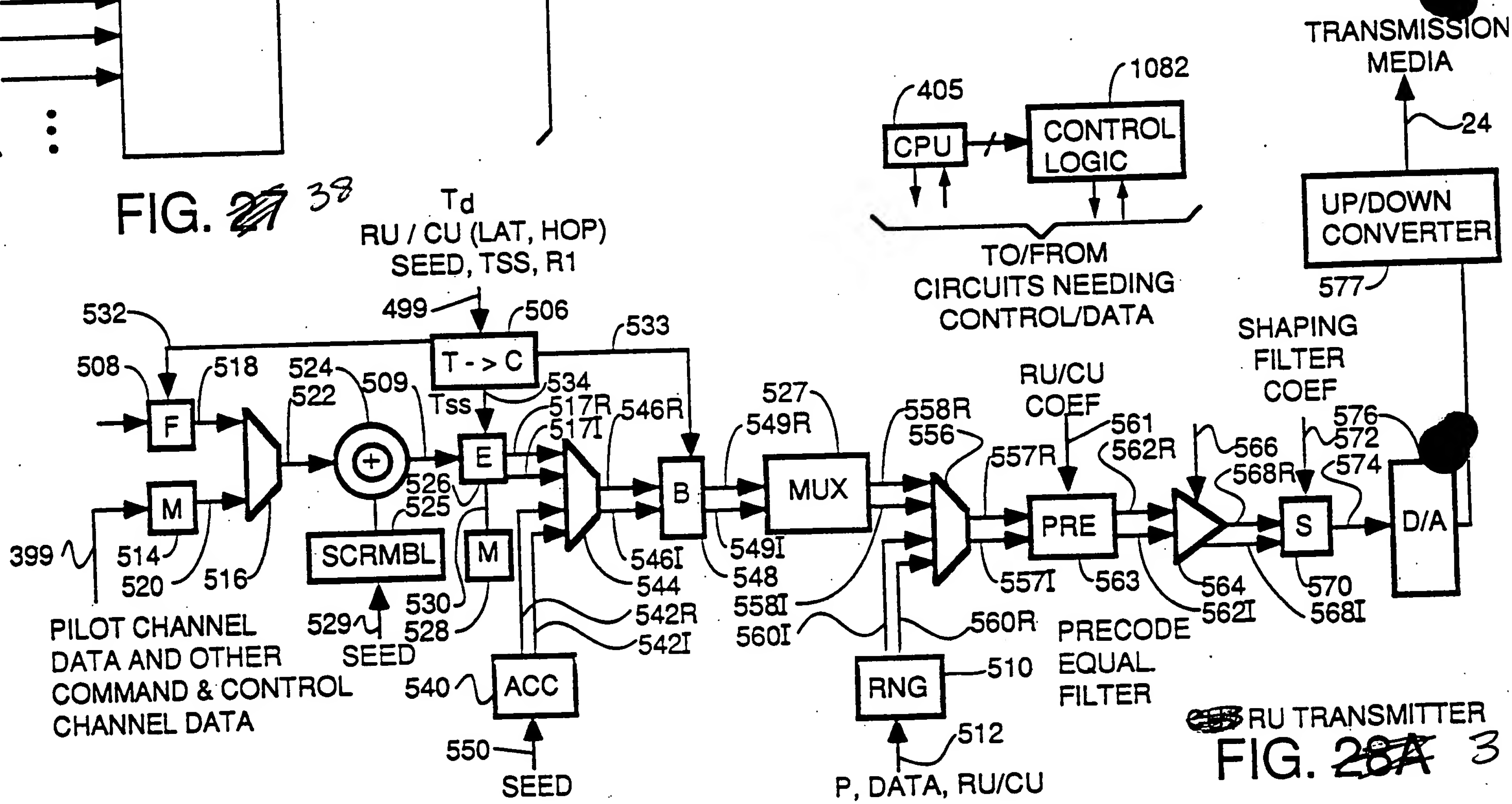
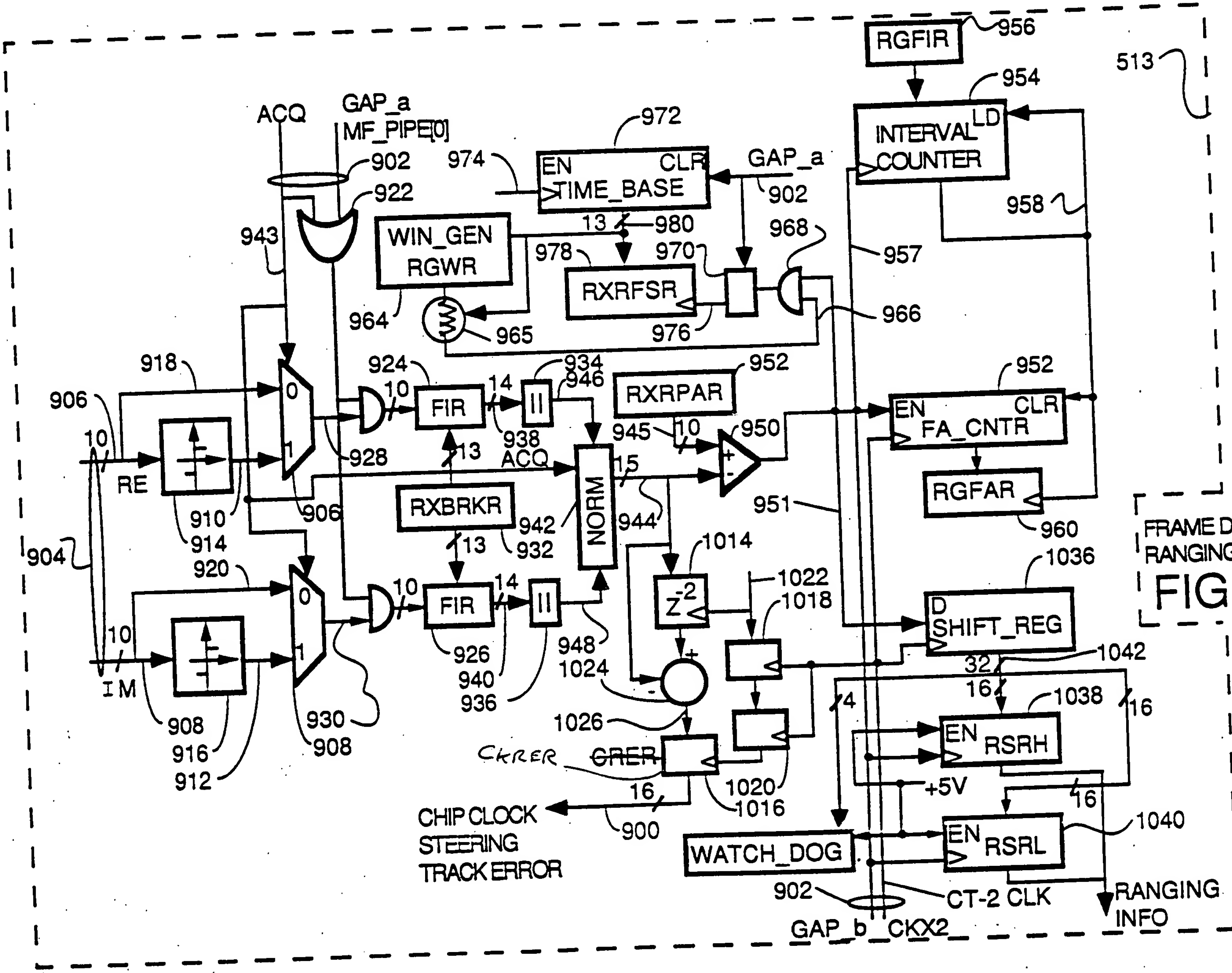


FIG. ~~27~~ 38



~~65~~ RU TRANSMITTER
FIG. ~~28A~~ 3



FRAME DETECTOR/
RANGING DETECTOR

FIG. ~~38~~ 3

GAP ACQUISITION TIMING

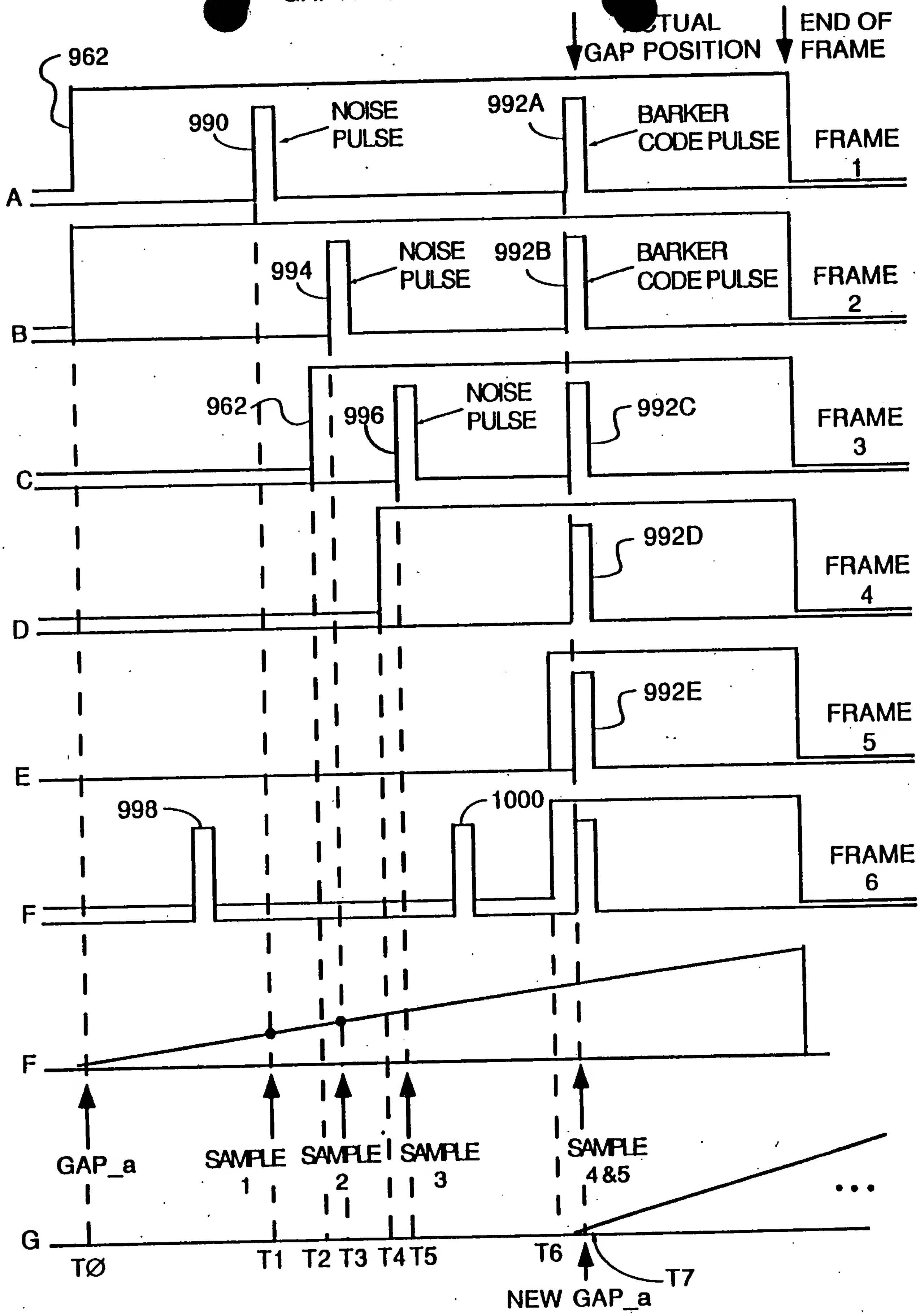


FIG. ~~39~~ 35

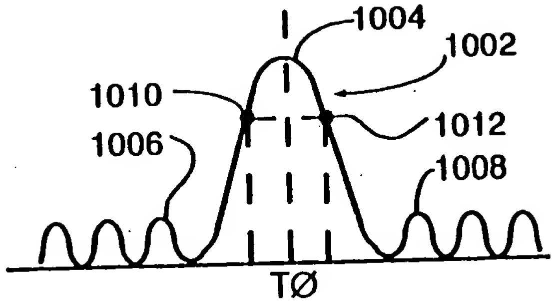


FIG. ~~40~~ 36

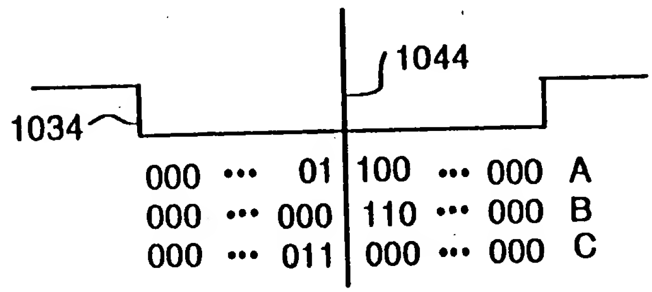


FIG. ~~41~~ 37

FINE TUNING
TO CENTER
BARKER CODE

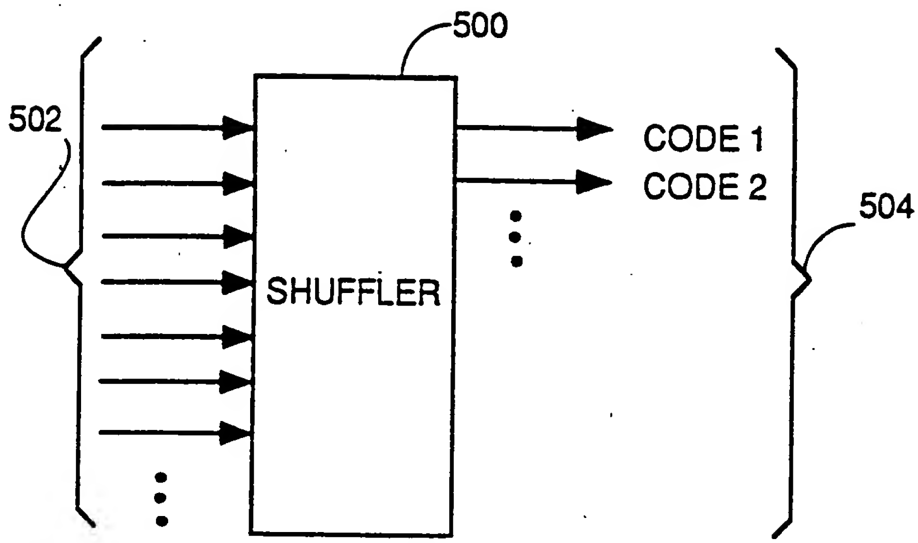


FIG. ~~27~~ 38

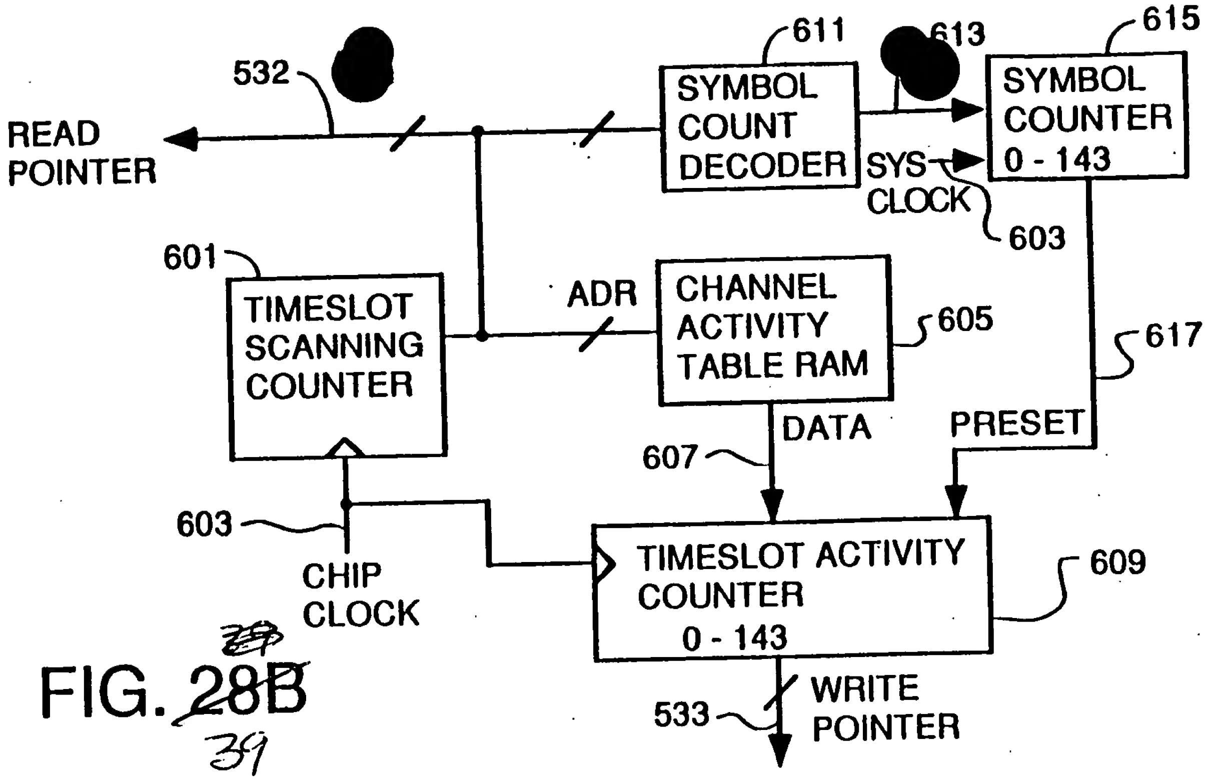


FIG. ~~28B~~ 39

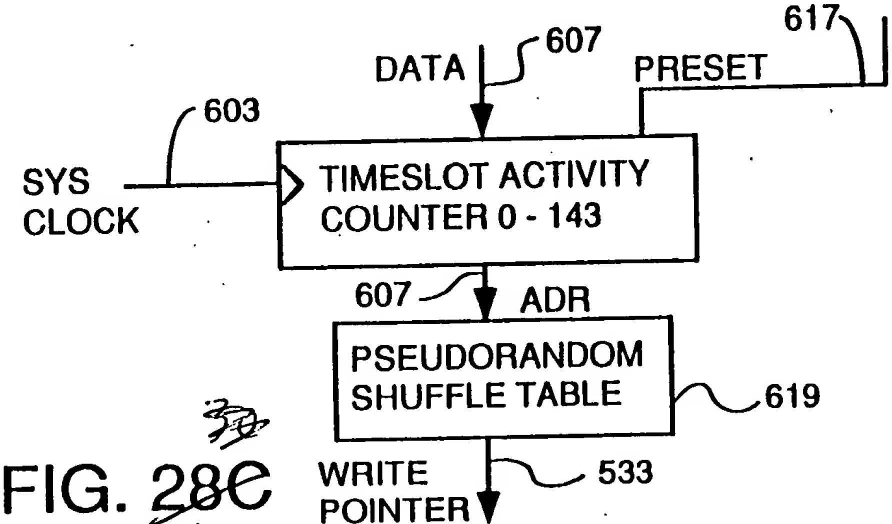


FIG. ~~28C~~ 40

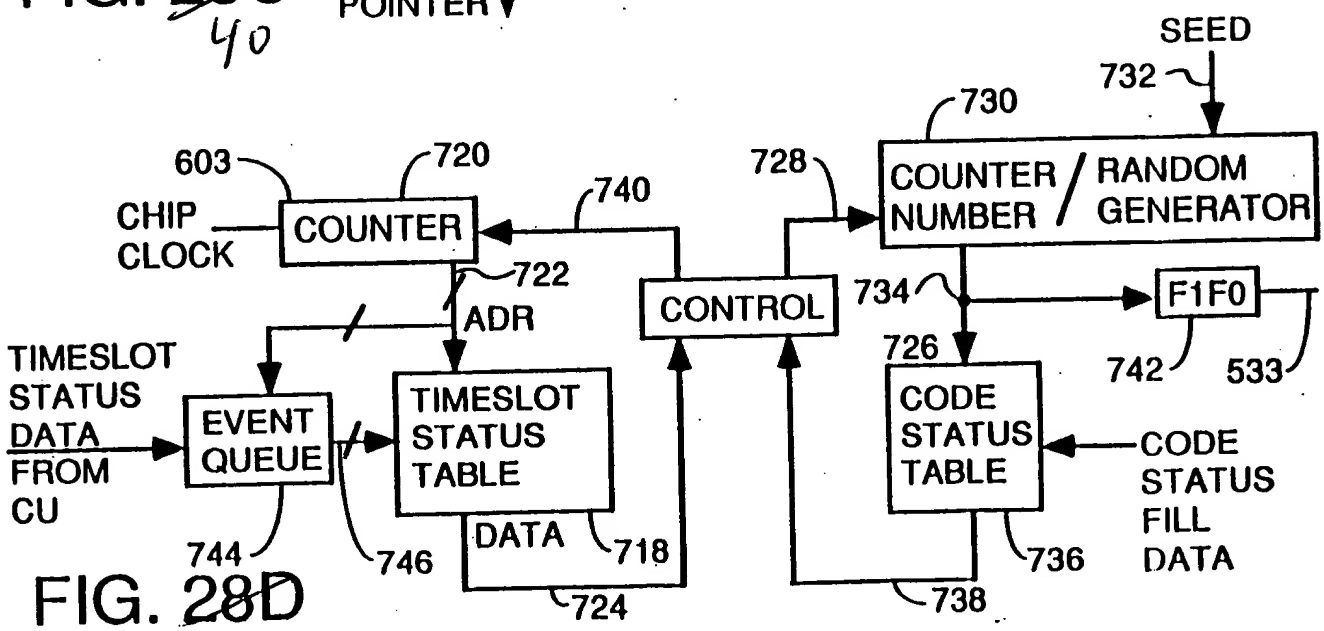


FIG. ~~28D~~ 41

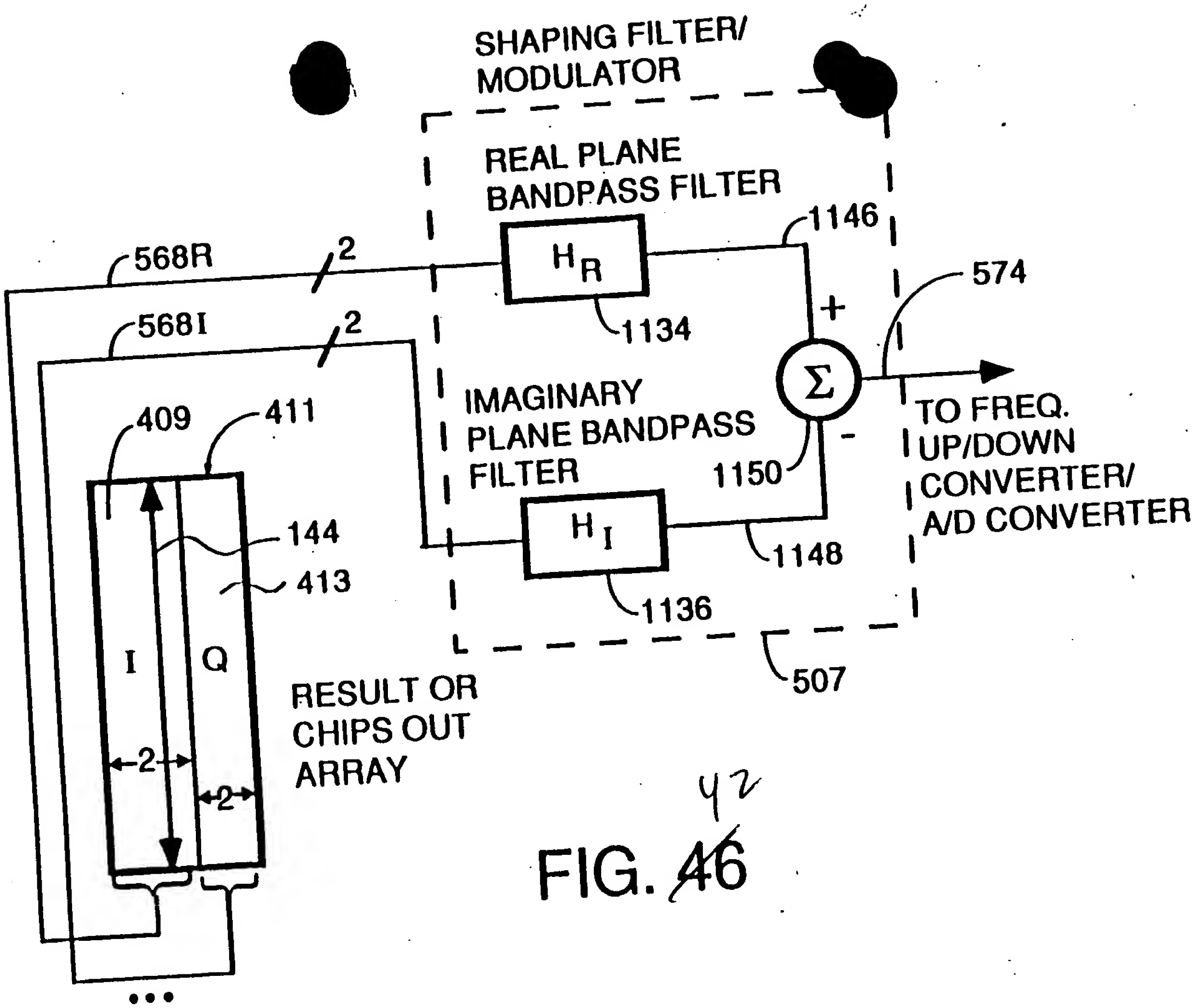


FIG. ~~46~~ 42

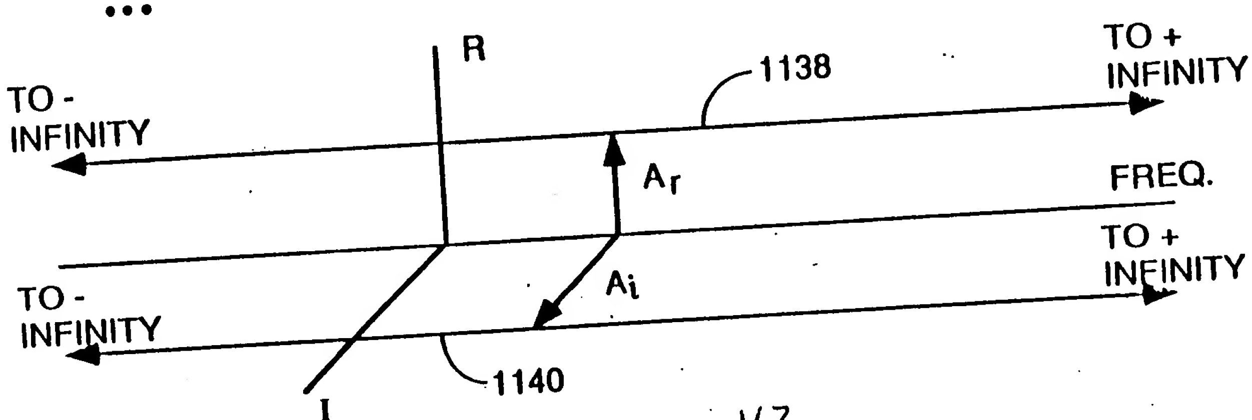


FIG. ~~47~~ 43

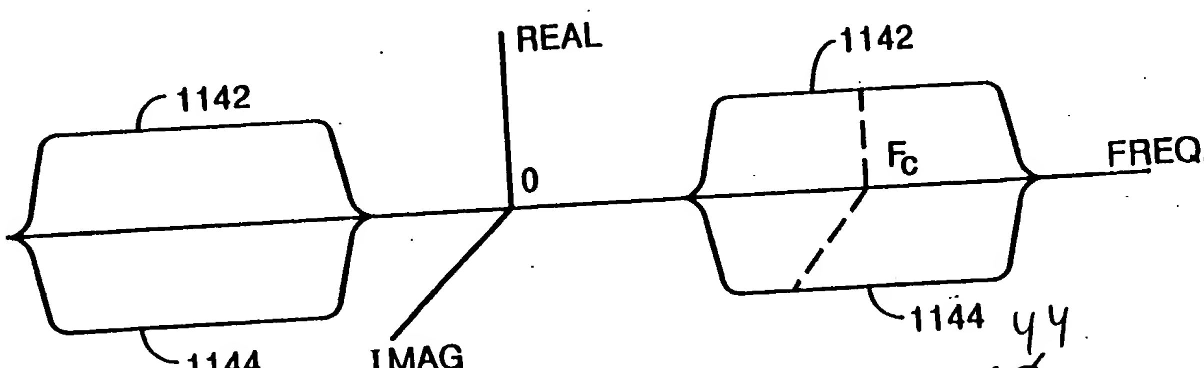
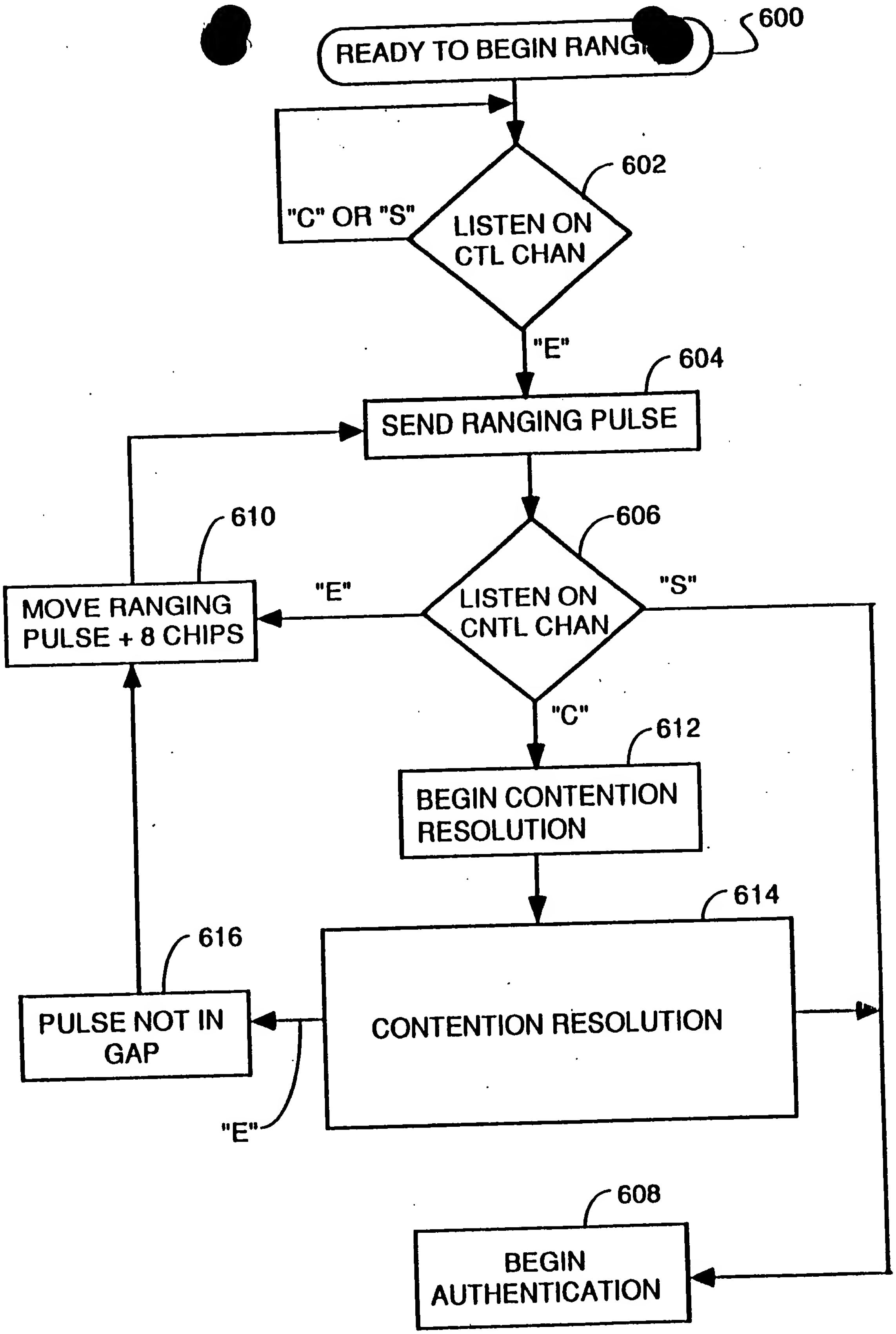
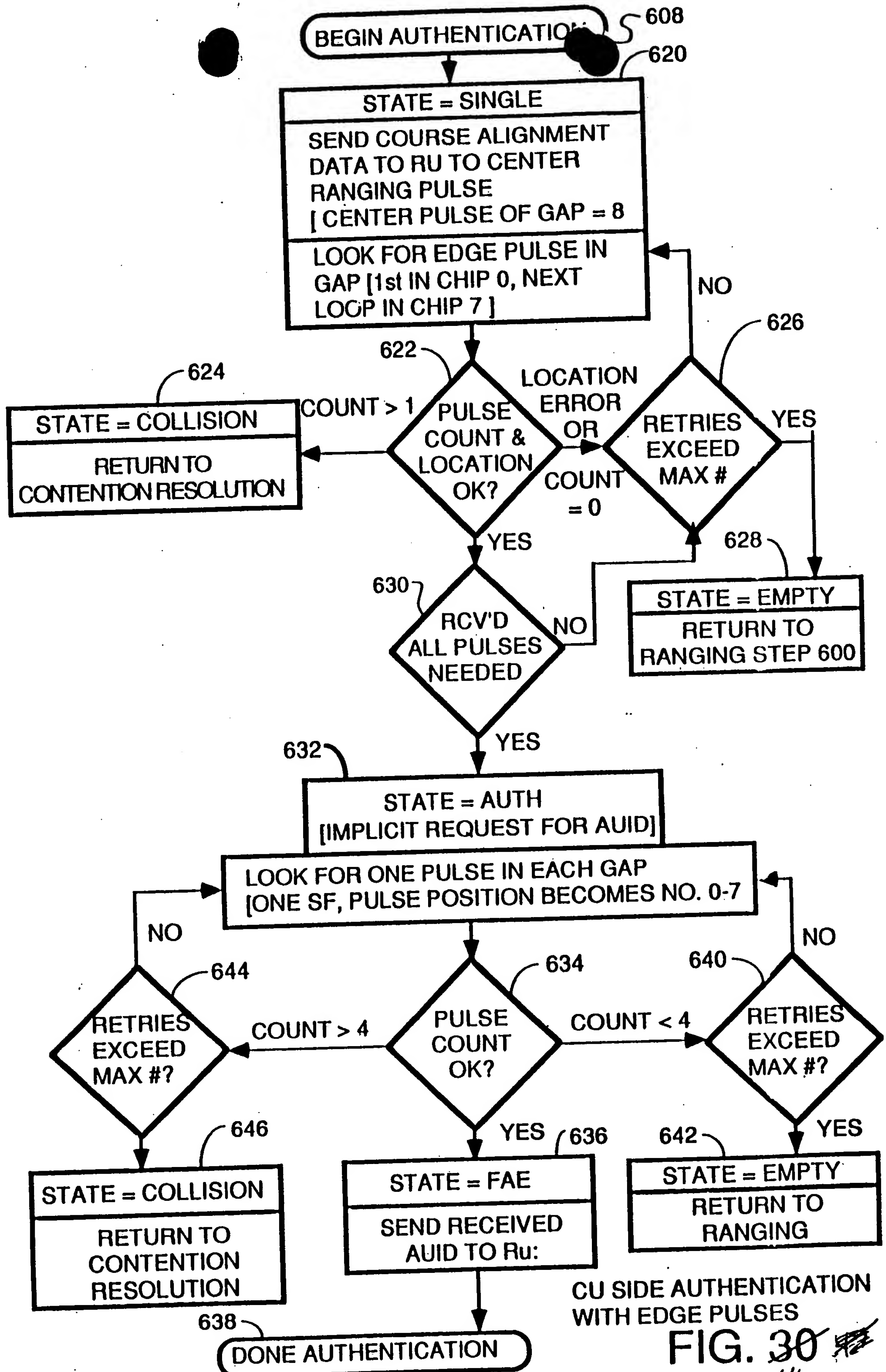


FIG. ~~48~~ 44



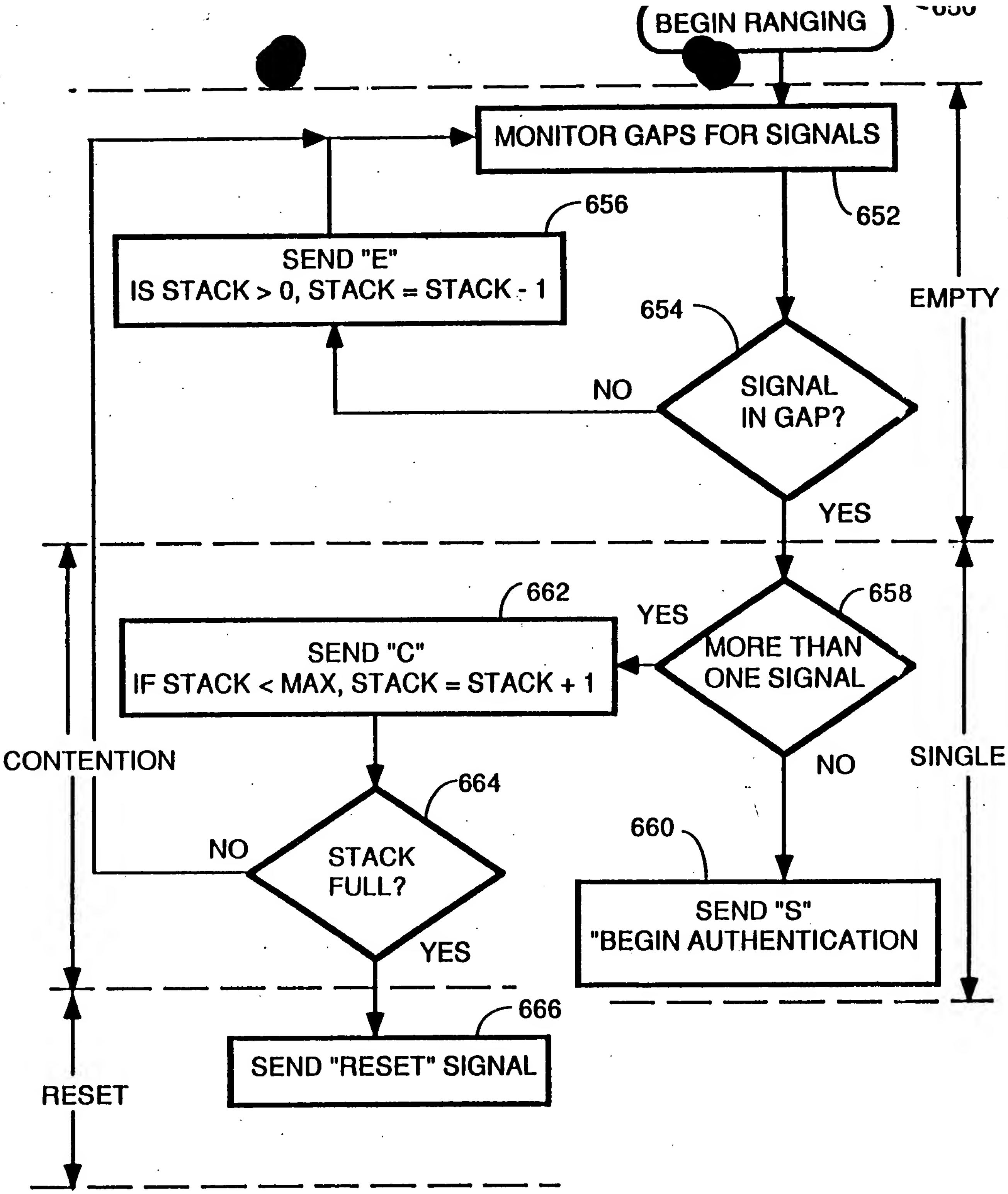
RU RANGING

FIG. 29



CU SIDE AUTHENTICATION WITH EDGE PULSES

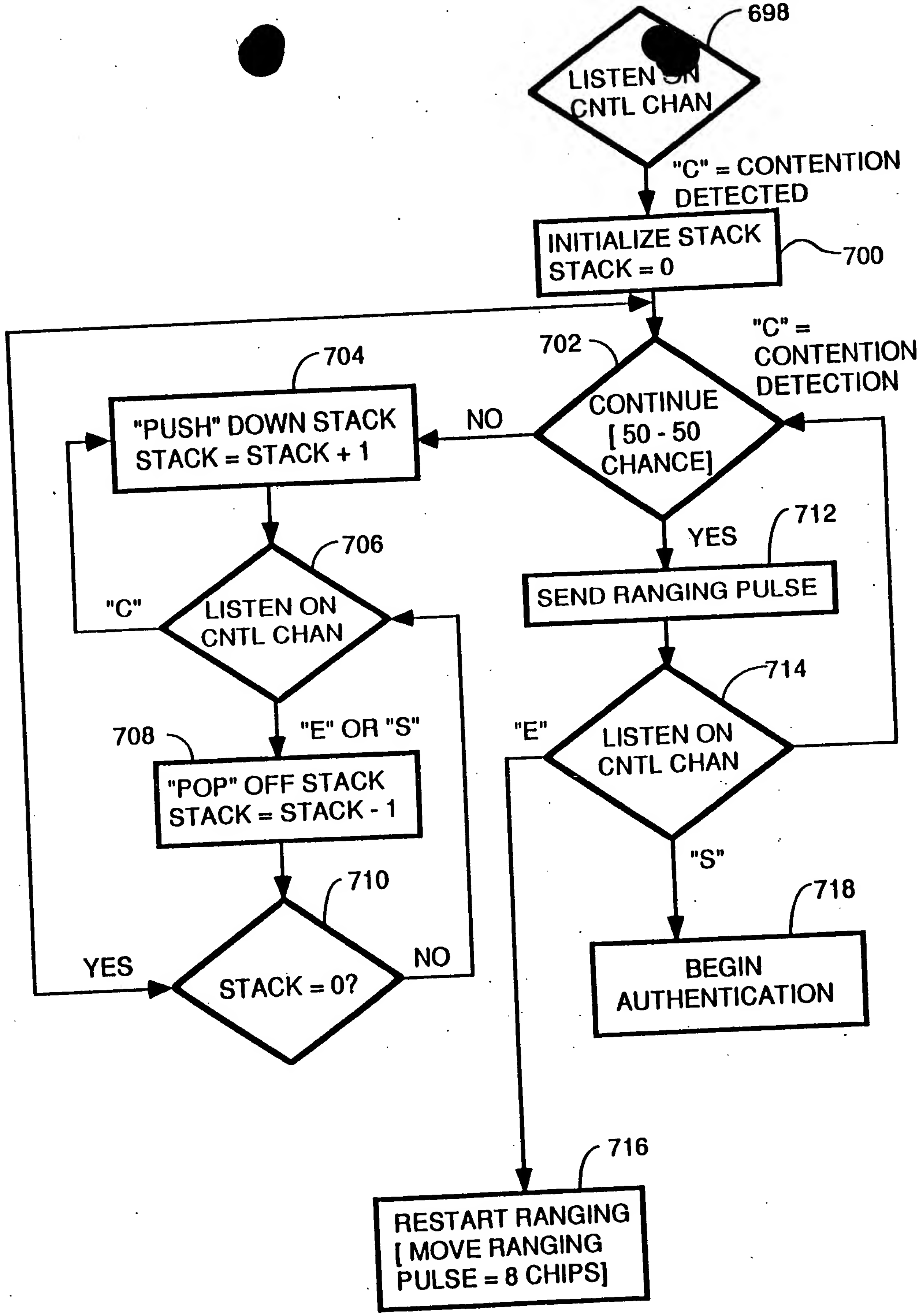
FIG. ~~30~~ 46



CU RANGING & CONTENTION RESOLUTION

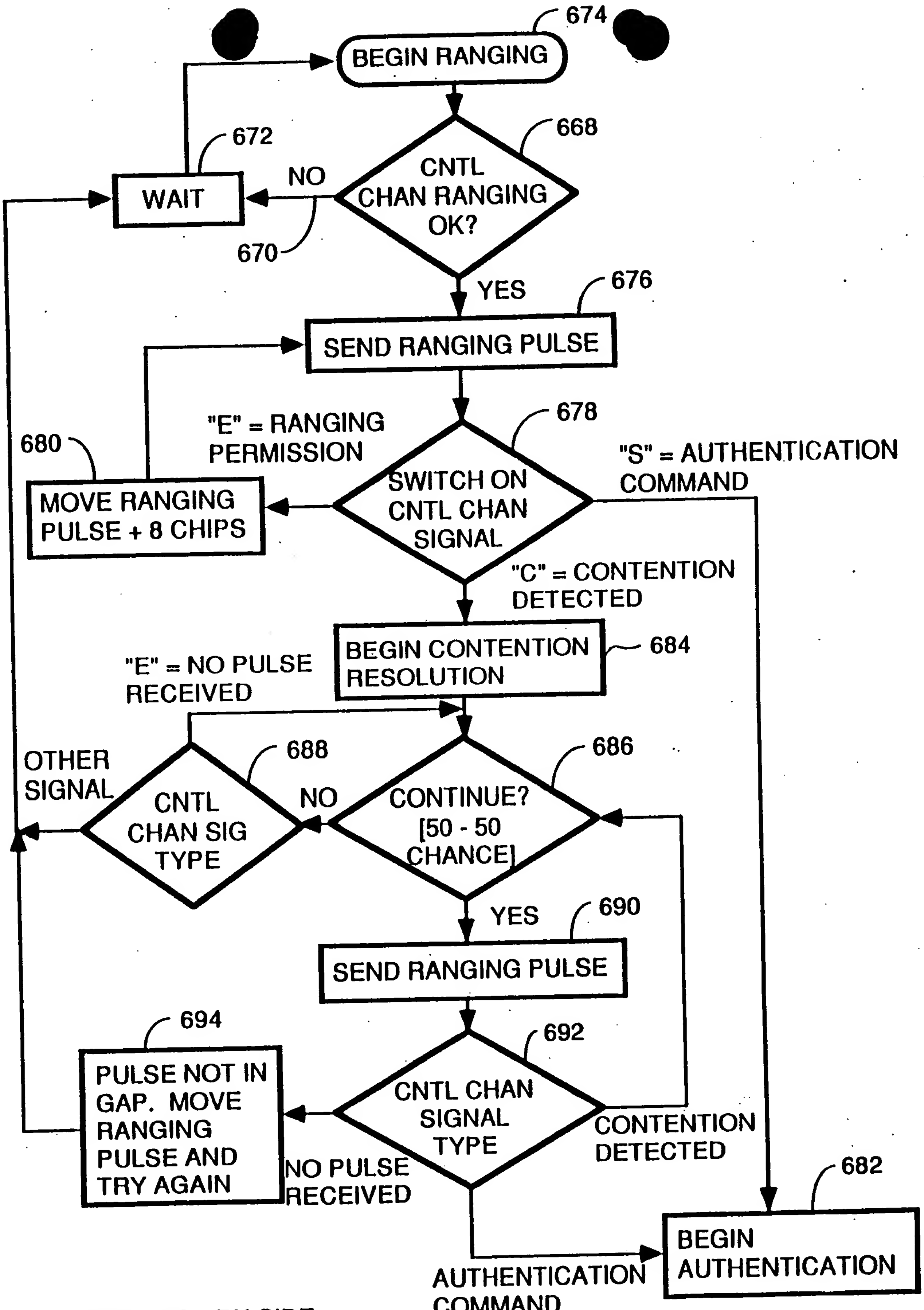
~~RANGING AND CONTENTION RESOLUTION~~
~~CU SIDE~~

FIG. ~~31~~ ~~48~~ 47



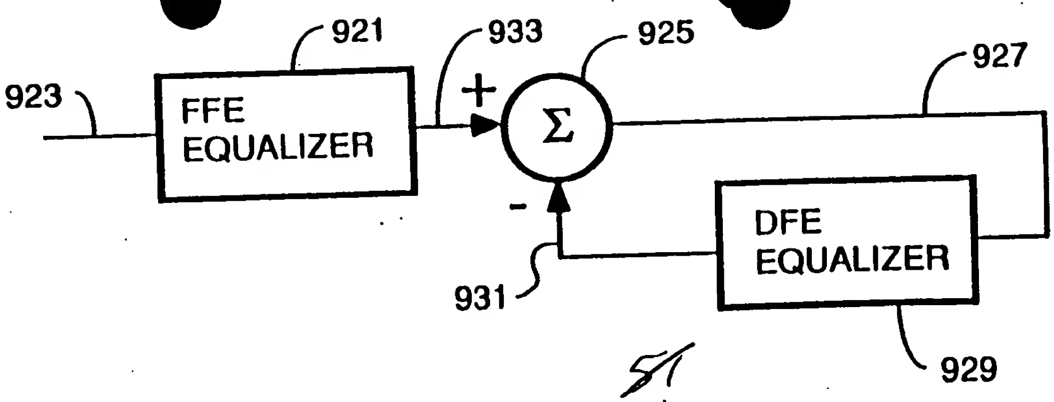
CONTENTION RESOLUTION - RU
USING BINARY STACK

FIG. ~~33~~ ~~49~~ 43

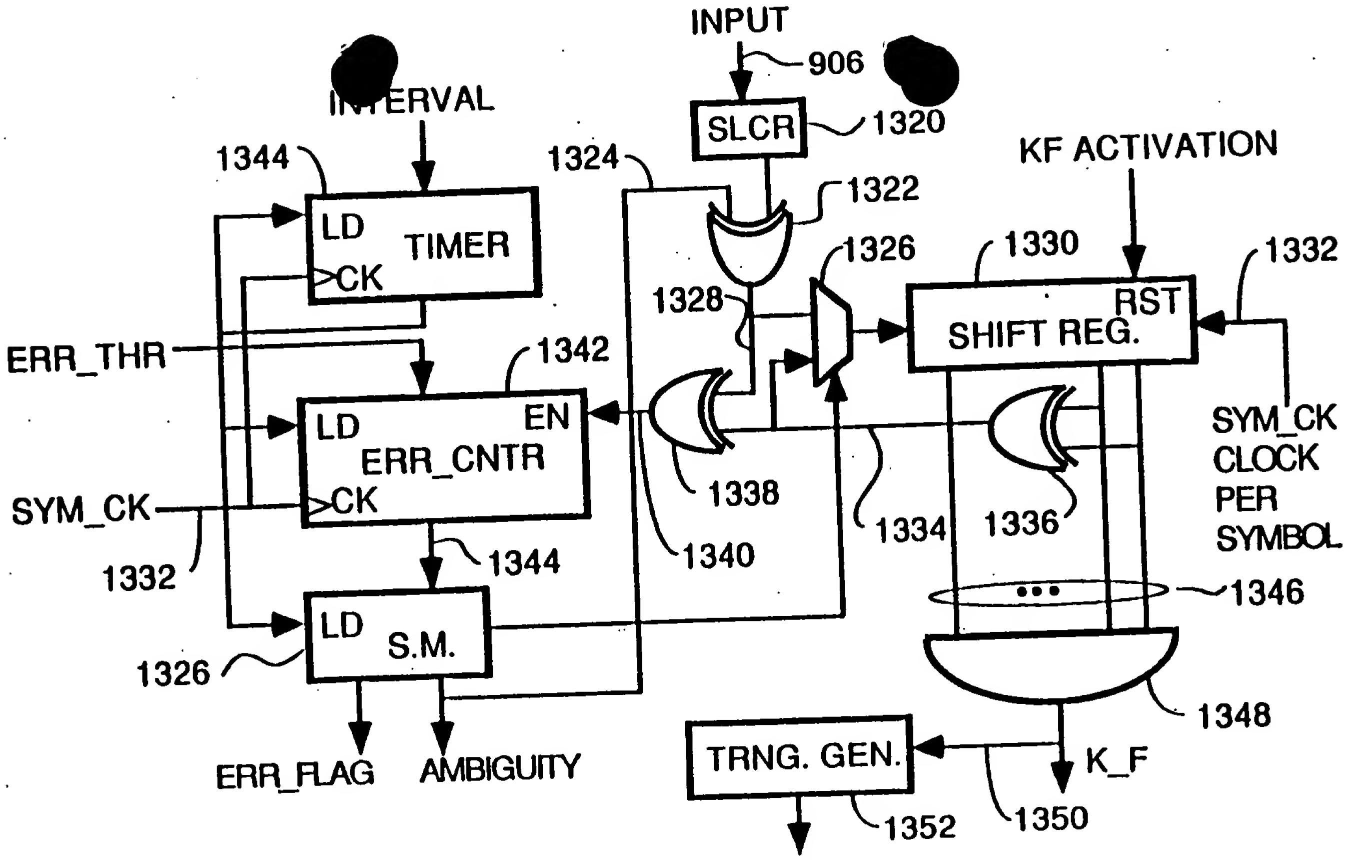


RANGING - RU SIDE BINARY TREE ALGORITHM

FIG. ~~32~~ ~~50~~ 49

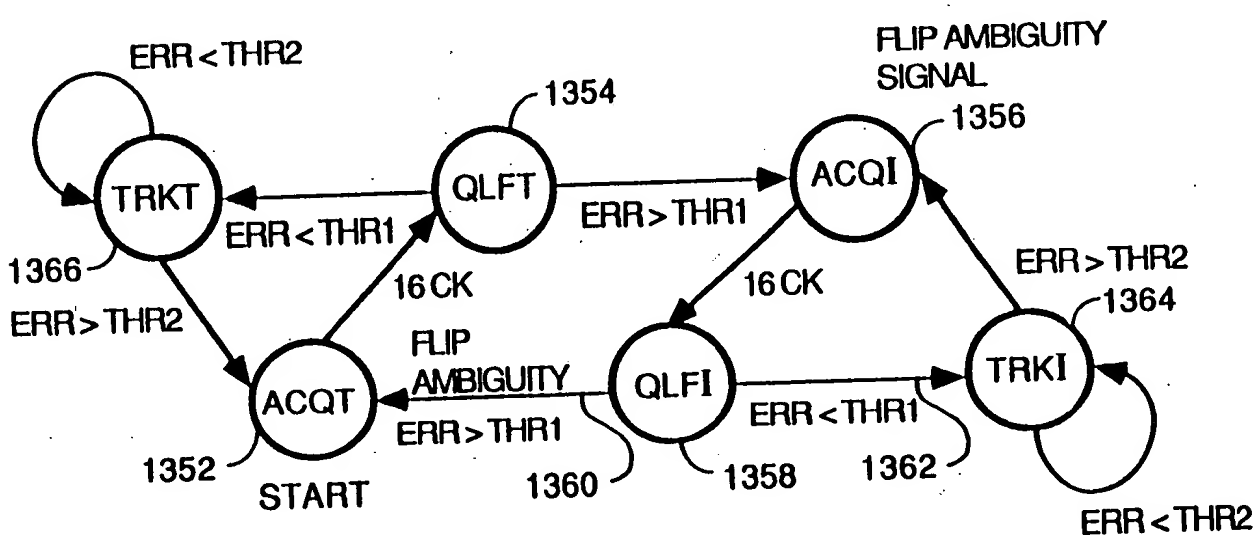


51
FIG. ~~37~~
50



FRAME DETECTOR
FRAME SYNC/KILOFRAME DETECT

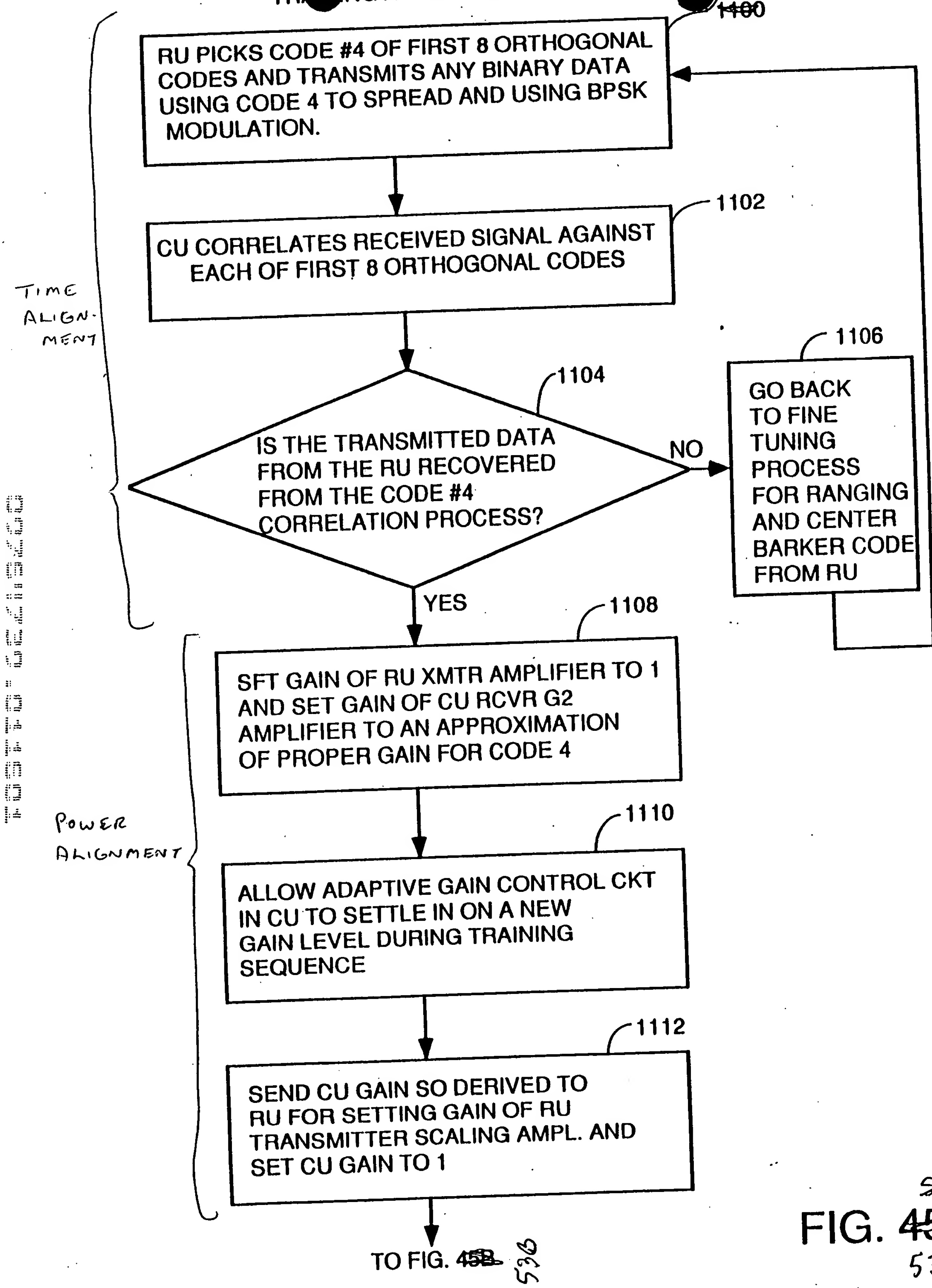
FIG. ~~52~~
51



STATE MACHINE

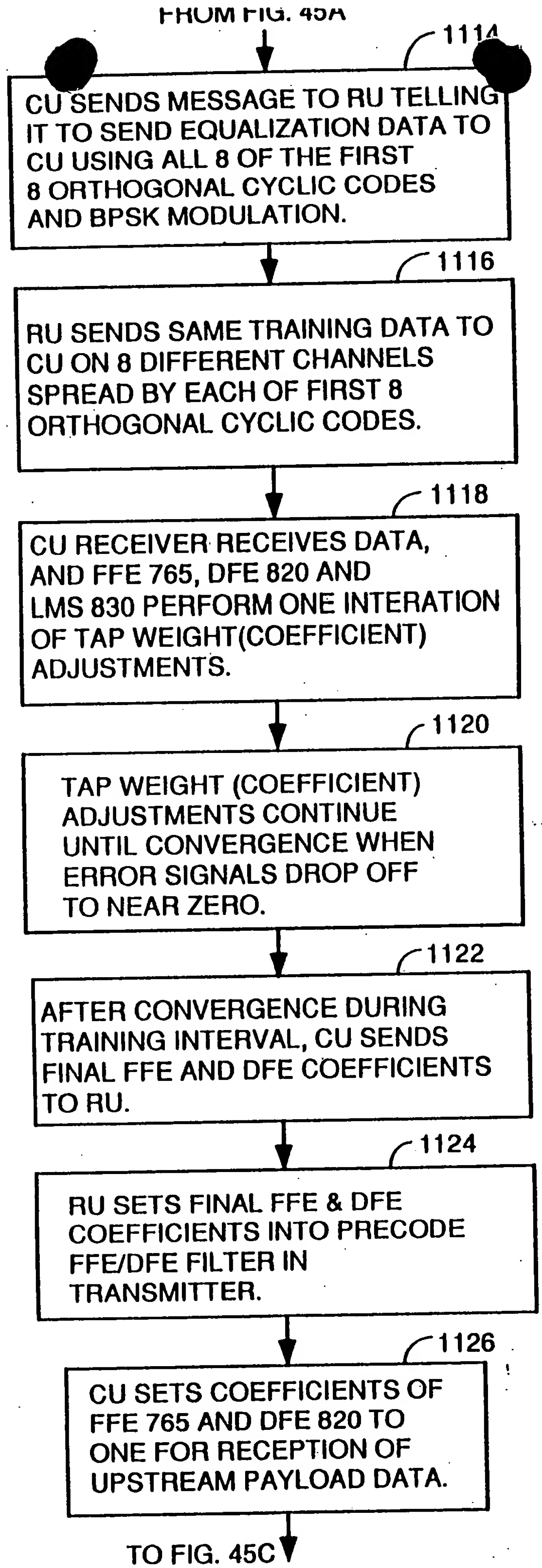
FIG. ~~53~~
52

PRECHANNEL EQUALIZATION TRAINING ALGORITHM



~~54A~~
FIG. ~~45A~~
53A

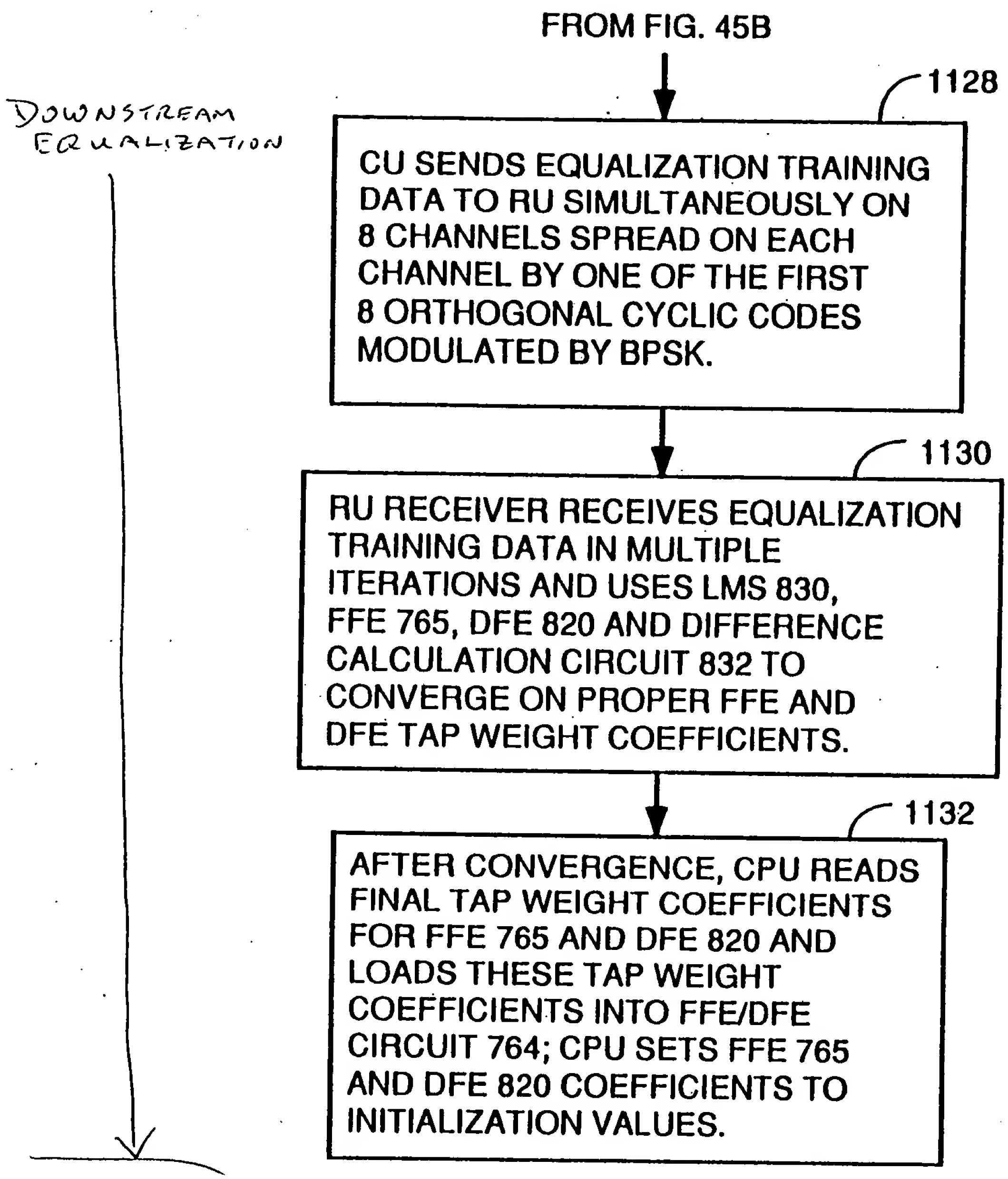
UPSTREAM EQUALIZATION



~~54B~~

FIG. ~~45B~~

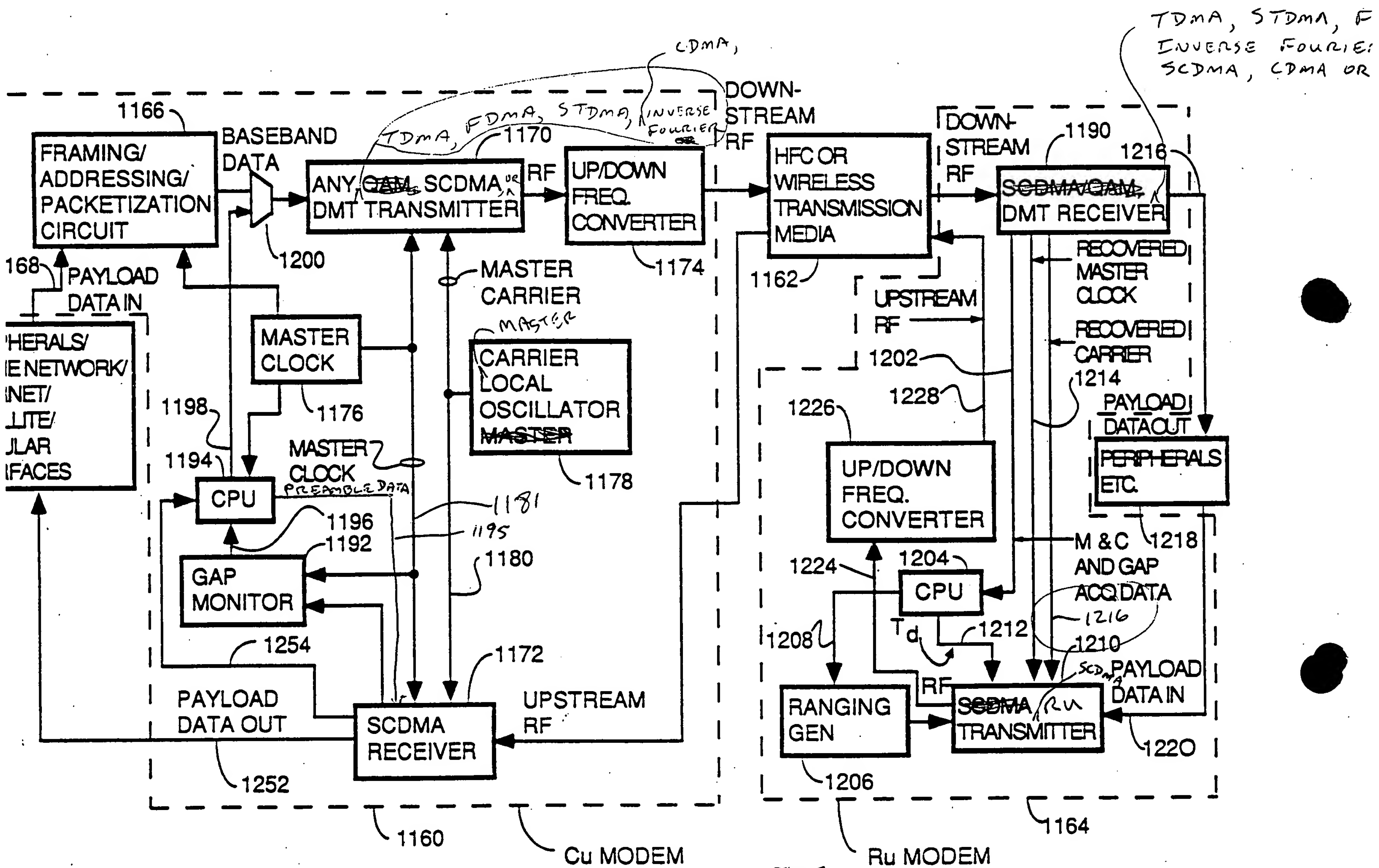
53B



~~54C~~

FIG. ~~45C~~

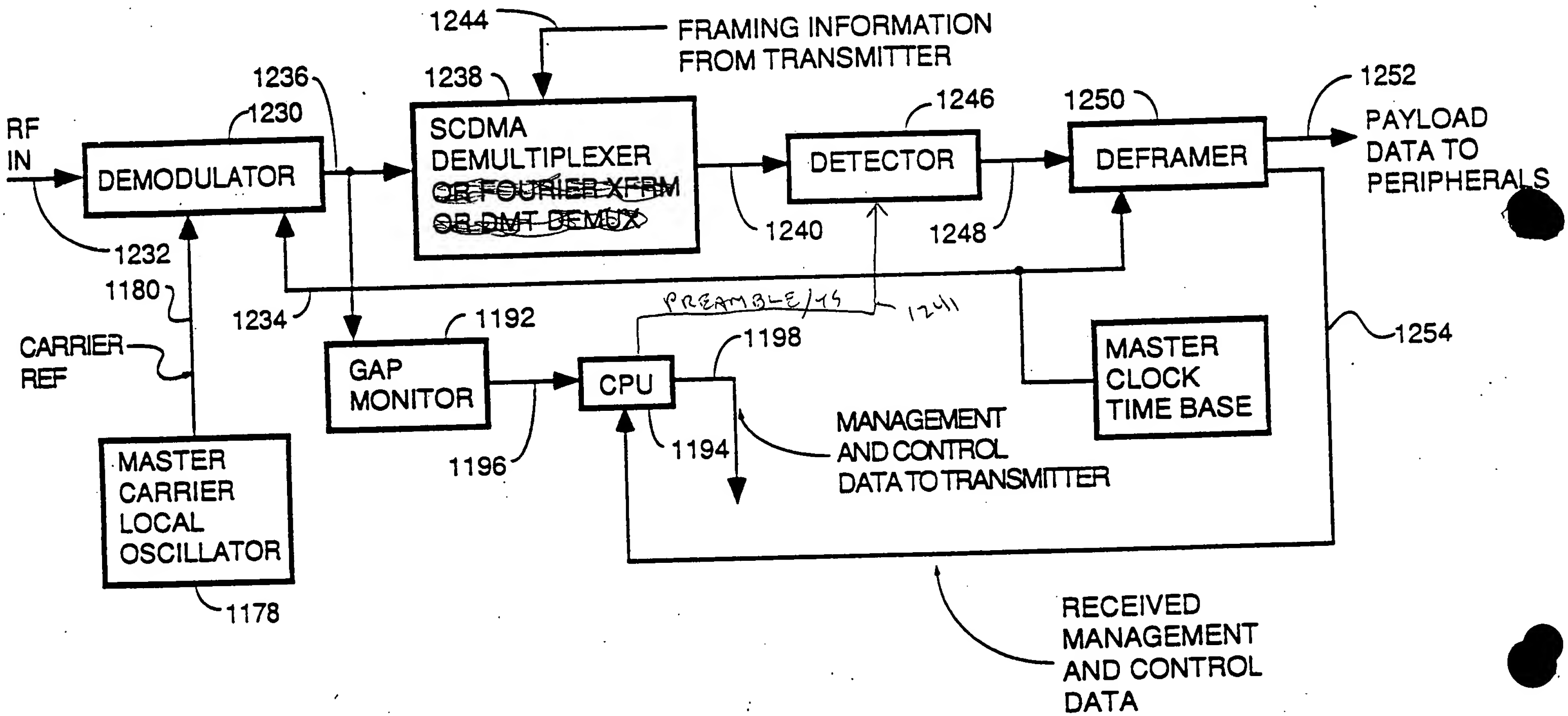
53C



TDMA, STDMA, F
INVERSE FOURIE
SCDMA, CDMA OR
1166
FRAMING/ ADDRESSING/ PACKETIZATION CIRCUIT
BASEBAND DATA
1200
TDMA, FDMA, STDMA, INVERSE FOURIER
CDMA,
1170
ANY ~~QAM~~ SCDMA OR A DMT TRANSMITTER
RF
UP/DOWN FREQ. CONVERTER
1174
DOWN-STREAM RF
HFC OR WIRELESS TRANSMISSION MEDIA
1162
168
PAYLOAD DATA IN
MASTER CLOCK
1176
MASTER CARRIER
MASTER
CARRIER LOCAL OSCILLATOR ~~MASTER~~
1178
1198
1194
CPU
MASTER CLOCK
PREAMBLE DATA
1196
1192
1181
1195
1180
GAP MONITOR
1254
1172
PAYLOAD DATA OUT
SCDMA RECEIVER
UPSTREAM RF
1252
1160
Cu MODEM
DOWN-STREAM RF
1190
1216
~~SCDMA/QAM~~ DMT RECEIVER
RECOVERED MASTER CLOCK
RECOVERED CARRIER
UPSTREAM RF
1202
1228
1214
PAYLOAD DATA OUT
PERIPHERALS ETC.
1226
UP/DOWN FREQ. CONVERTER
1218
M & C AND GAP ACQ DATA
1224
1204
CPU
1216
1208
Td
1212
1210
SCDMA
PAYLOAD DATA IN
RF
RANGING GEN
~~SCDMA~~ RU TRANSMITTER
1220
1206
1164
Ru MODEM

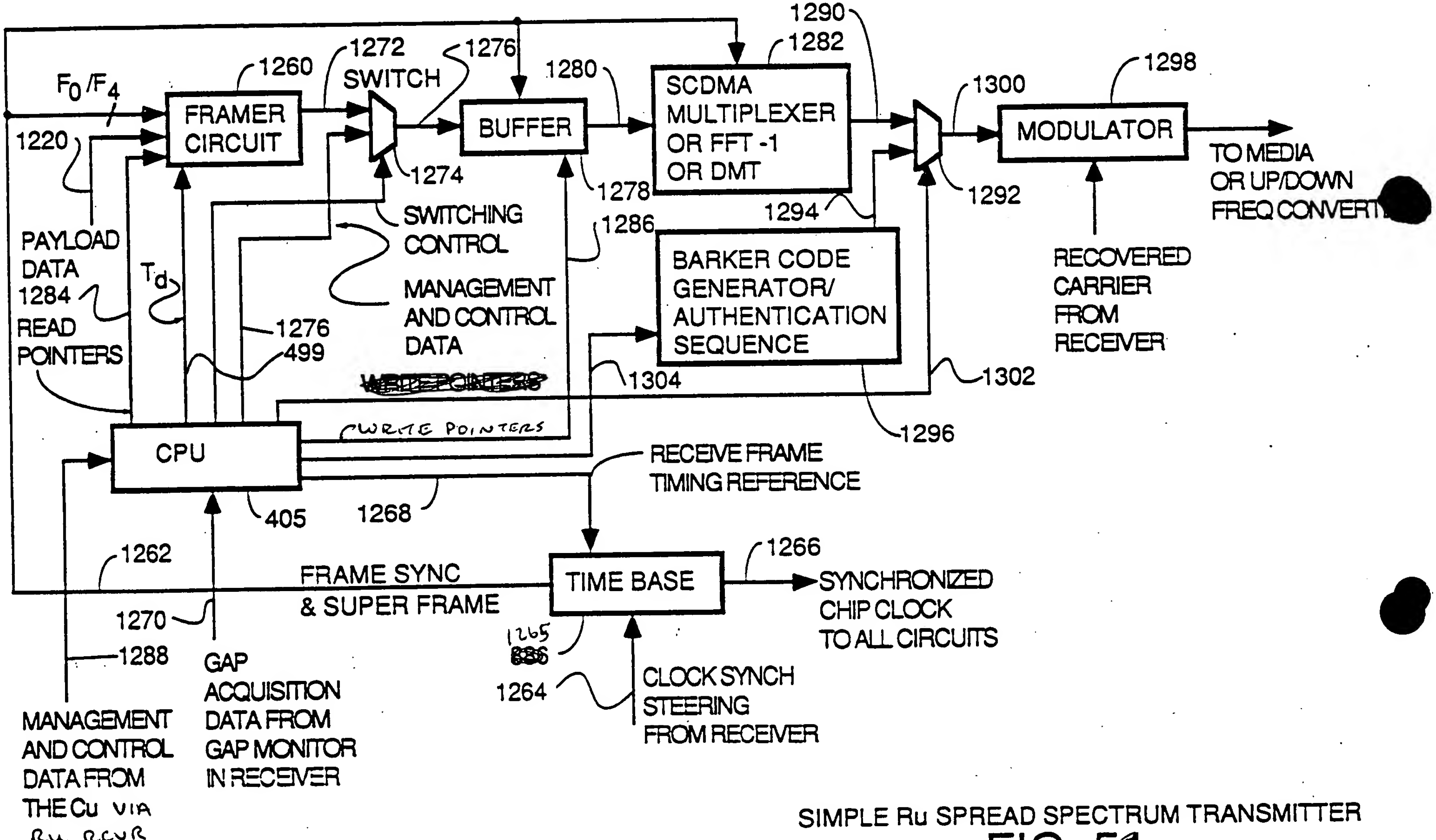
FIG. ~~49~~ ~~55~~ 54

07554160 .022301



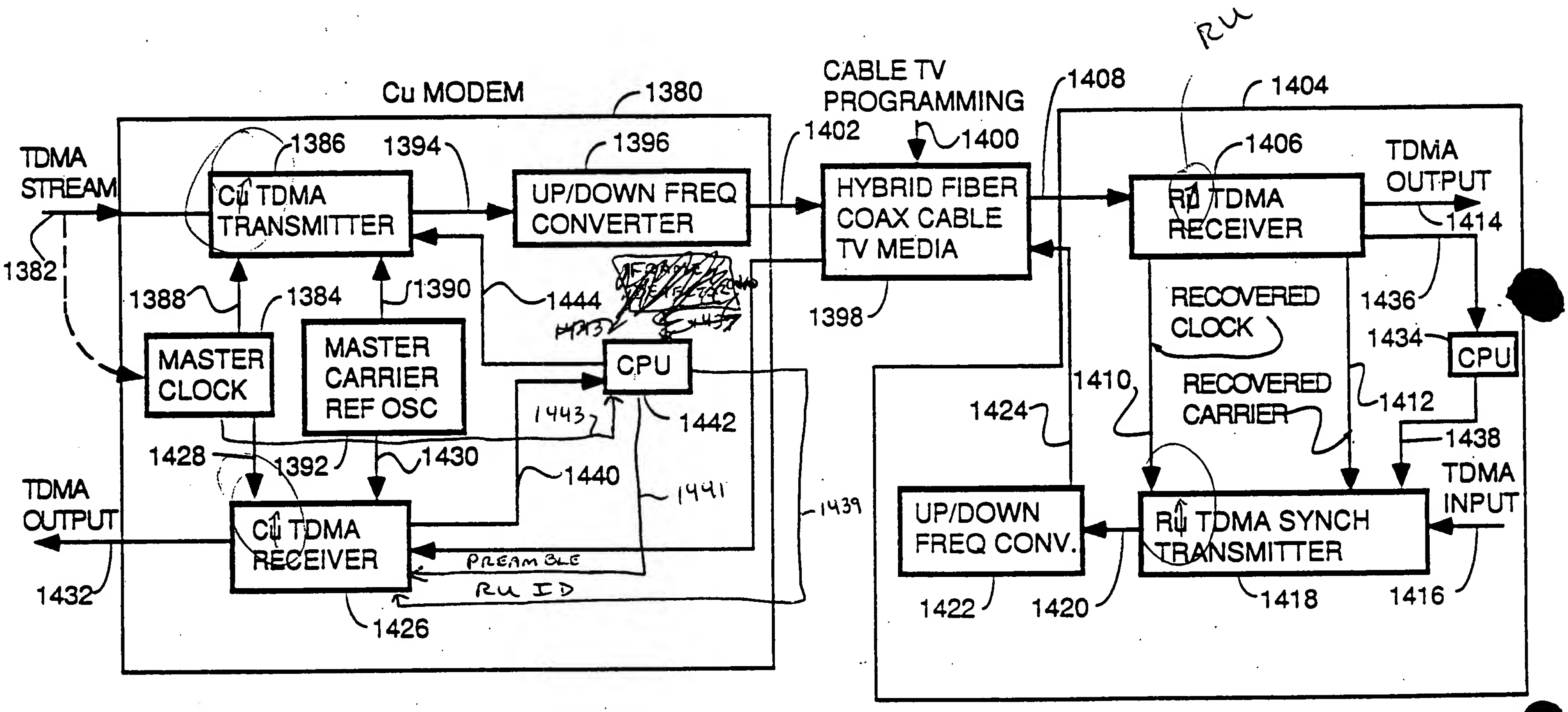
SIMPLE Cu SPREAD SPECTRUM RECEIVER

FIG. ~~50~~ ~~56~~ 55



SIMPLE Ru SPREAD SPECTRUM TRANSMITTER

FIG. ~~51~~ ~~57~~ 56



SYNCHRONOUS TDMA SYSTEM

FIG. ~~54~~ ~~58~~ 57

OFFSET	1B ASIC		2A ASIC	
(Chips)	RGSRH	RGSRL	RGSRH	RGSRL
0	0x0000	0x8000	0x0001	0x0000
1/2	0x0000	0xC000	0x0001	0x8000
1	0x0000	0x4000	0x0000	0x8000
-1	0x0001	0x0000	0x0002	0x0000

FIG. 58

Training Algorithm

SE Function

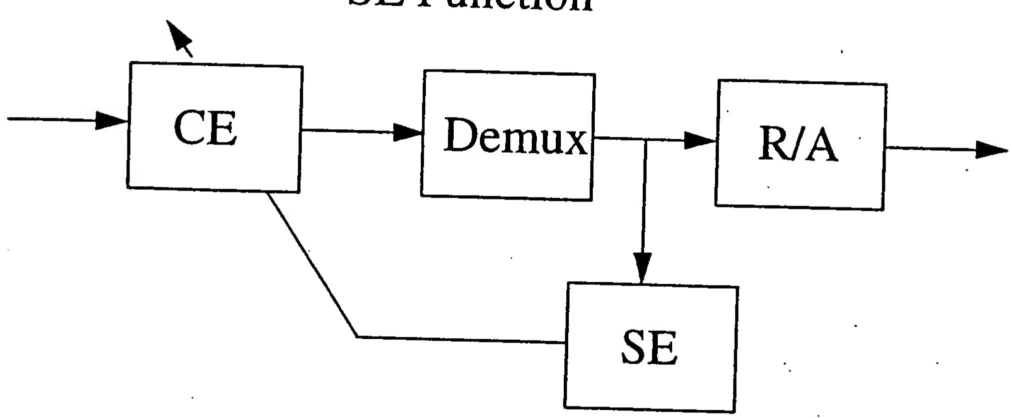
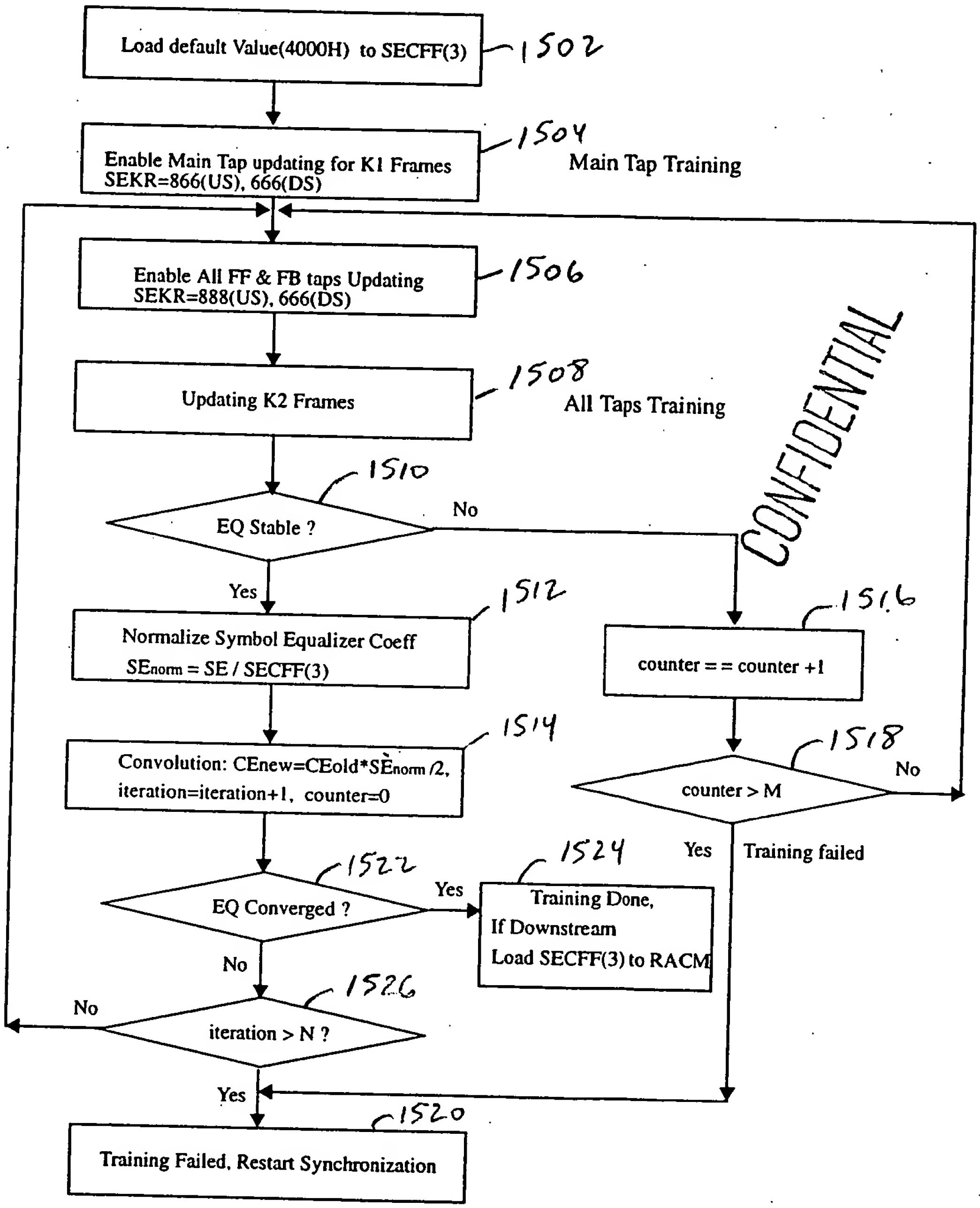


FIG. 59

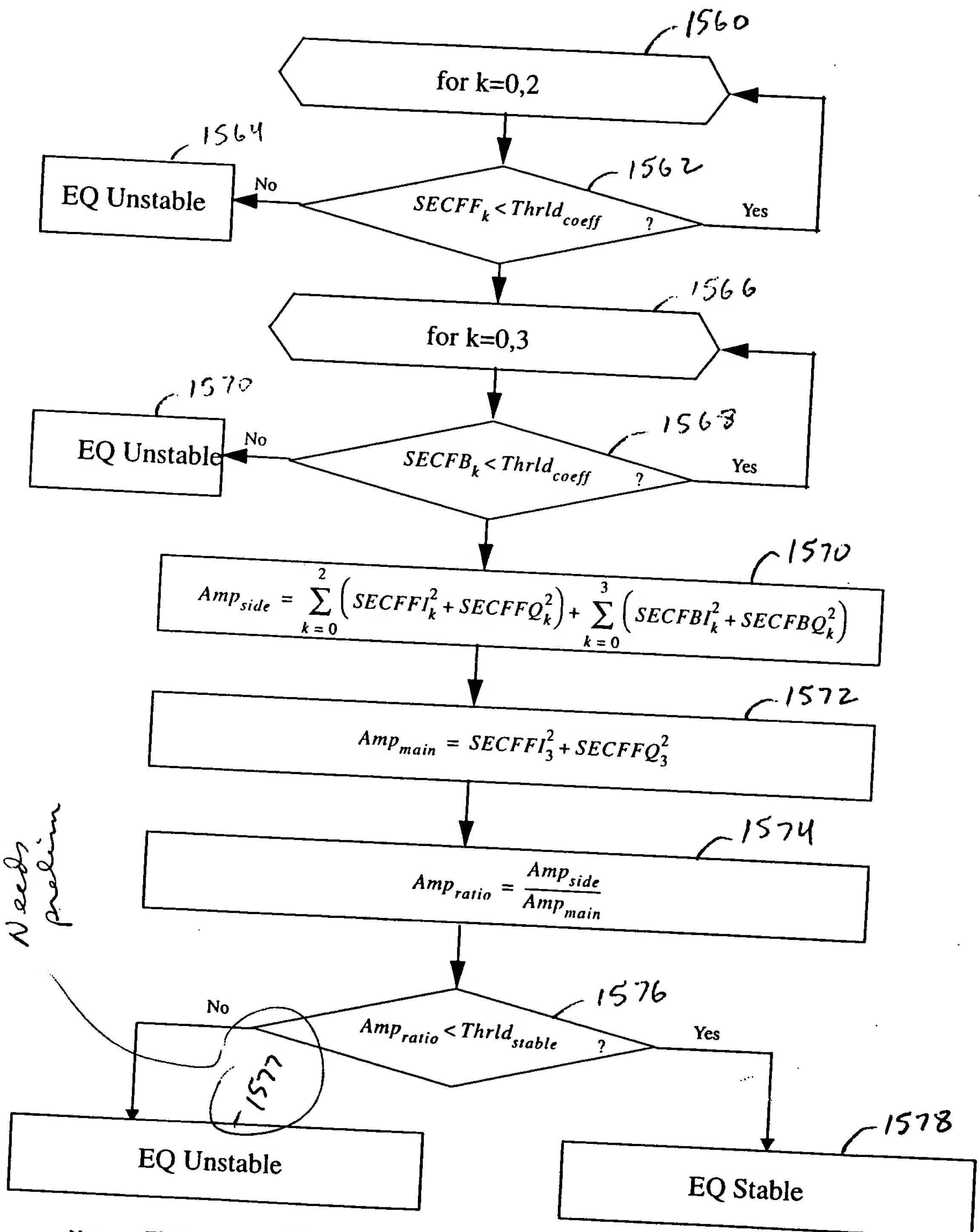
Initial 2-Step Training Algorithm



2-STEP INITIAL EQUALIZATION TRAINING

FIG. 60

EQ Stability Check



Note: $Thrld_{coeff} = 7F00H$ $Thrld_{stable} = 10^{-3}$

FIG. 61

Periodic 2-Step Training Algorithm

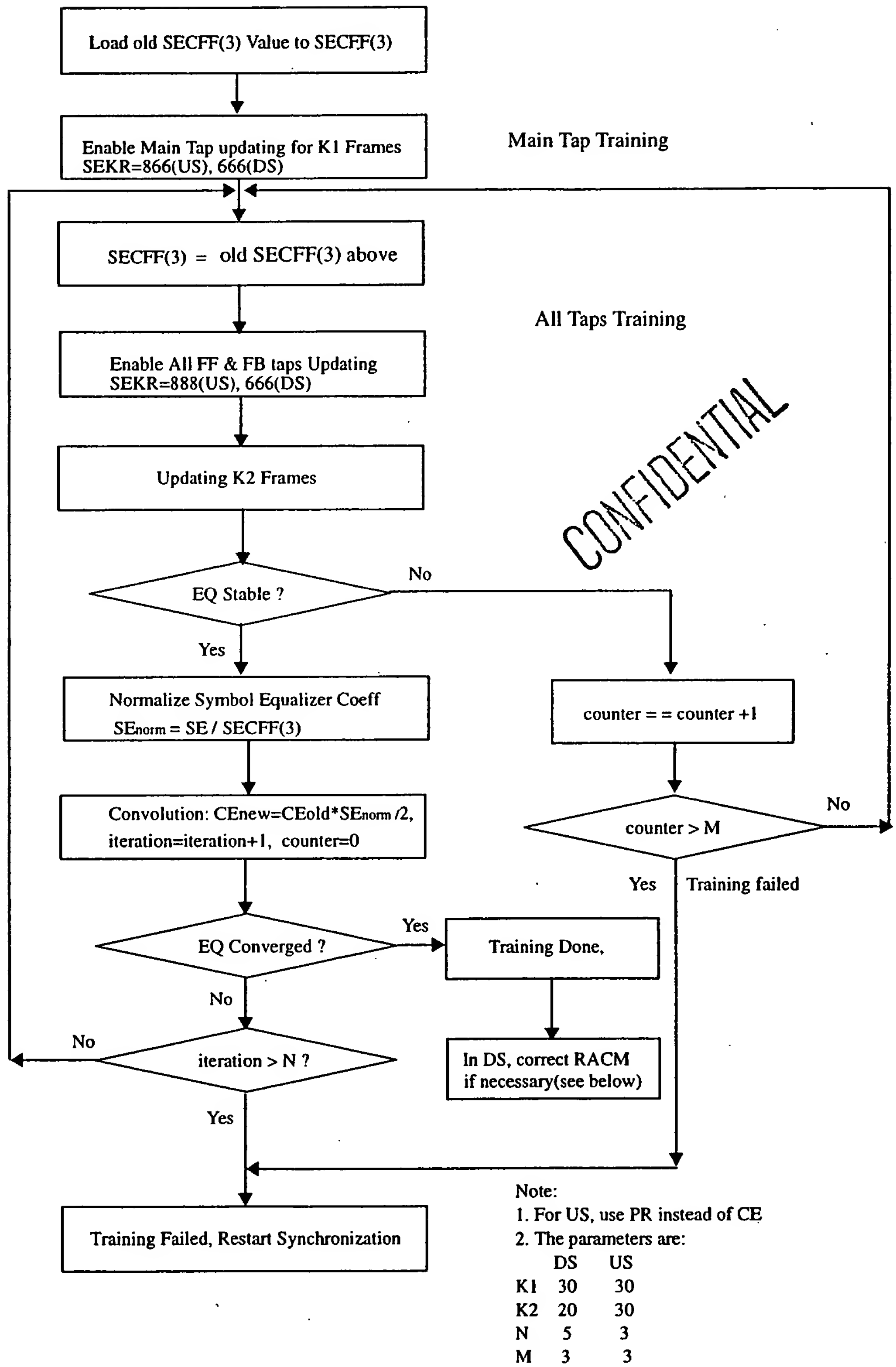
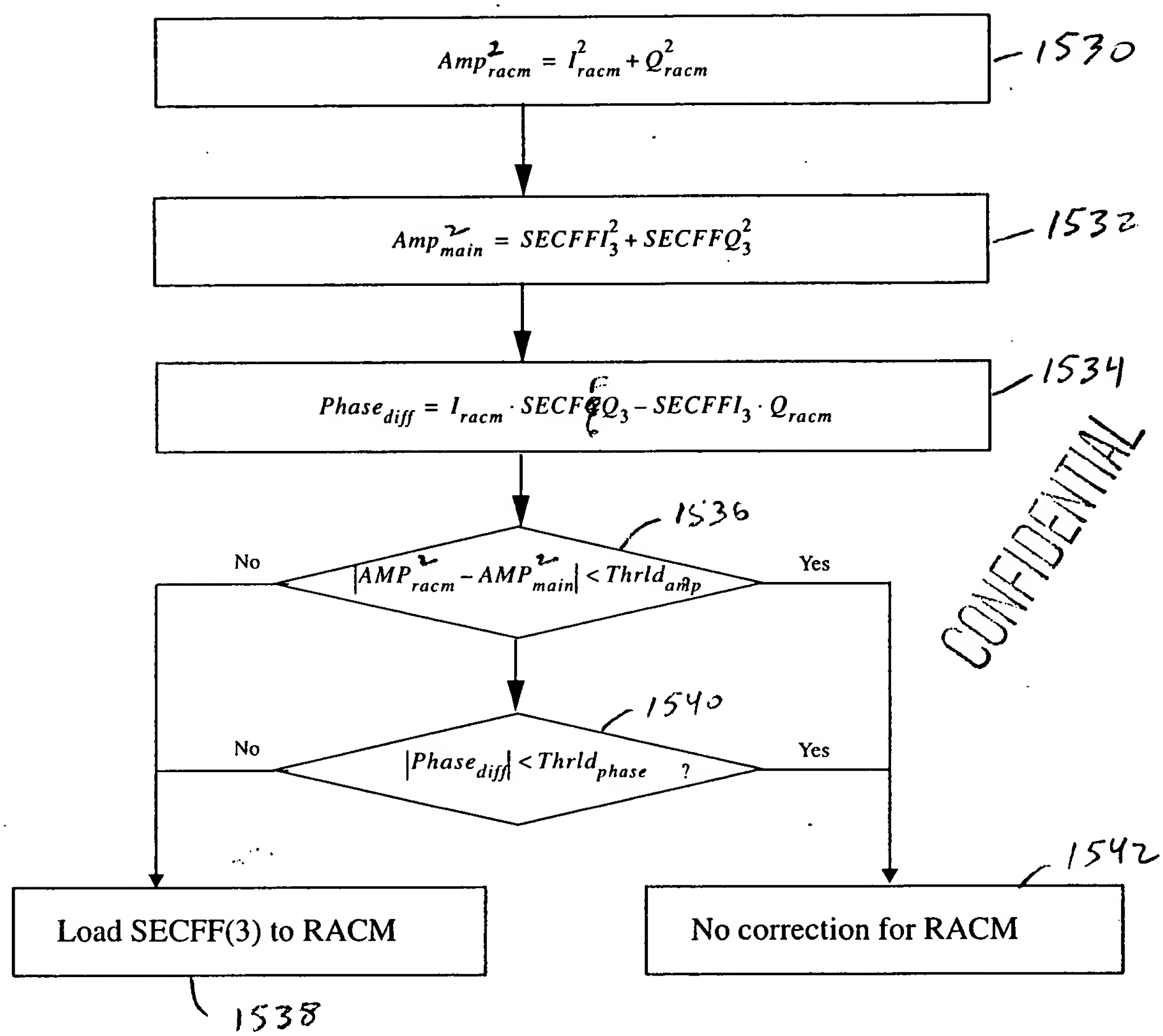


FIG. 62

RACM Correction



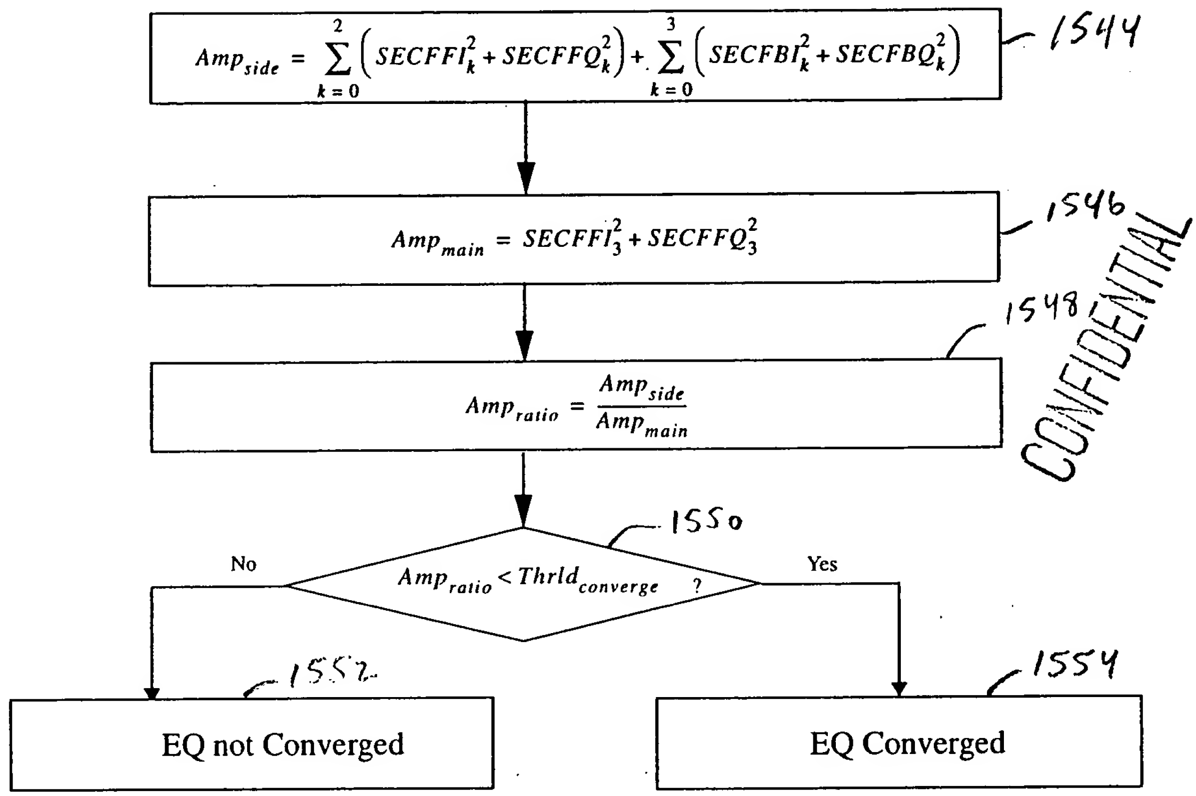
Note: $Thrld_{amp} = TBD$

$Thrld_{phase} = TBD$

ROTATIONAL AMPLIFIER CORRECTION

FIG. 63

EQ Convergence Check



Note: $Thrld_{converge} = 10^{-5}$

FIG. 64

Power Alignment Flow Chart

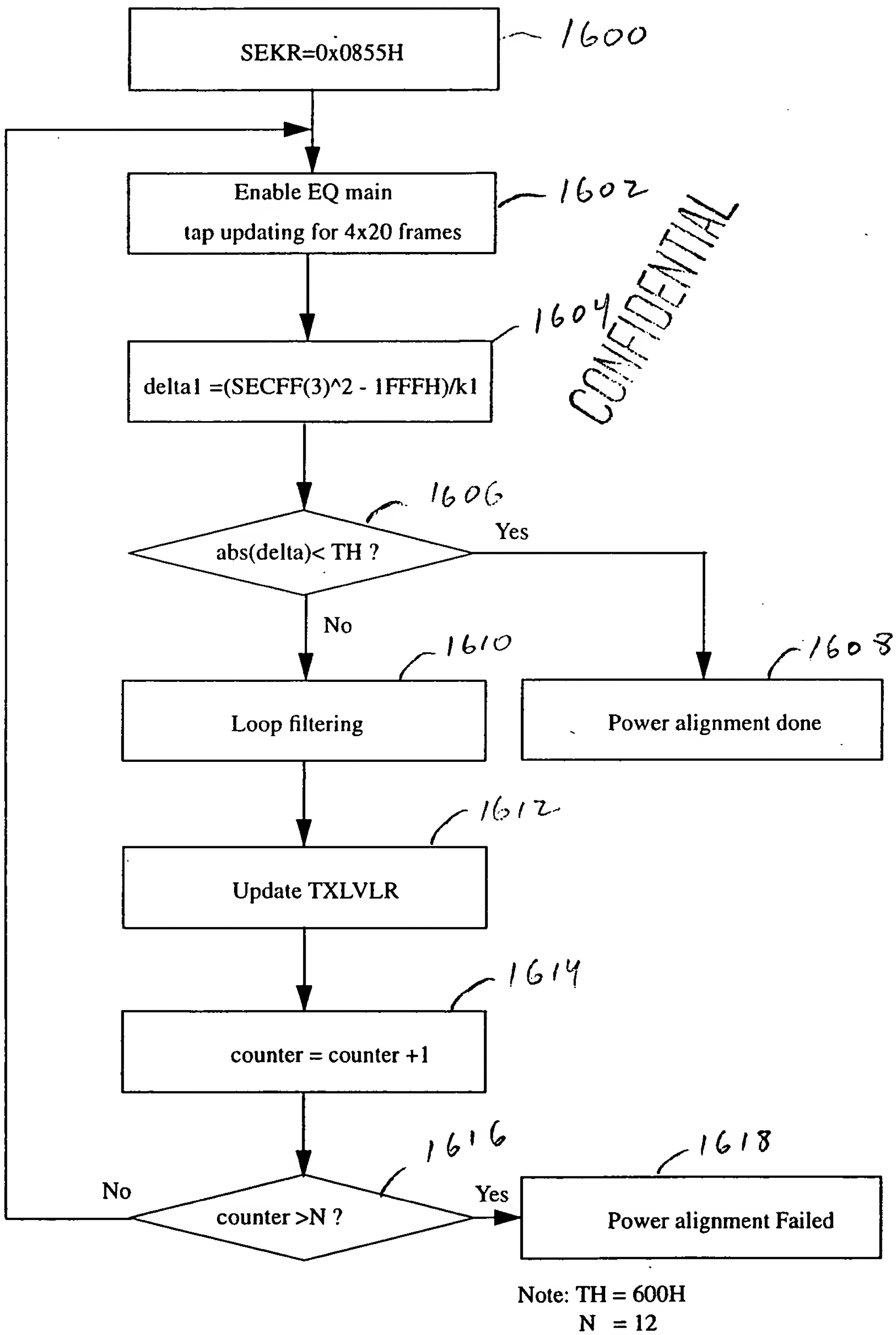


FIG. 65

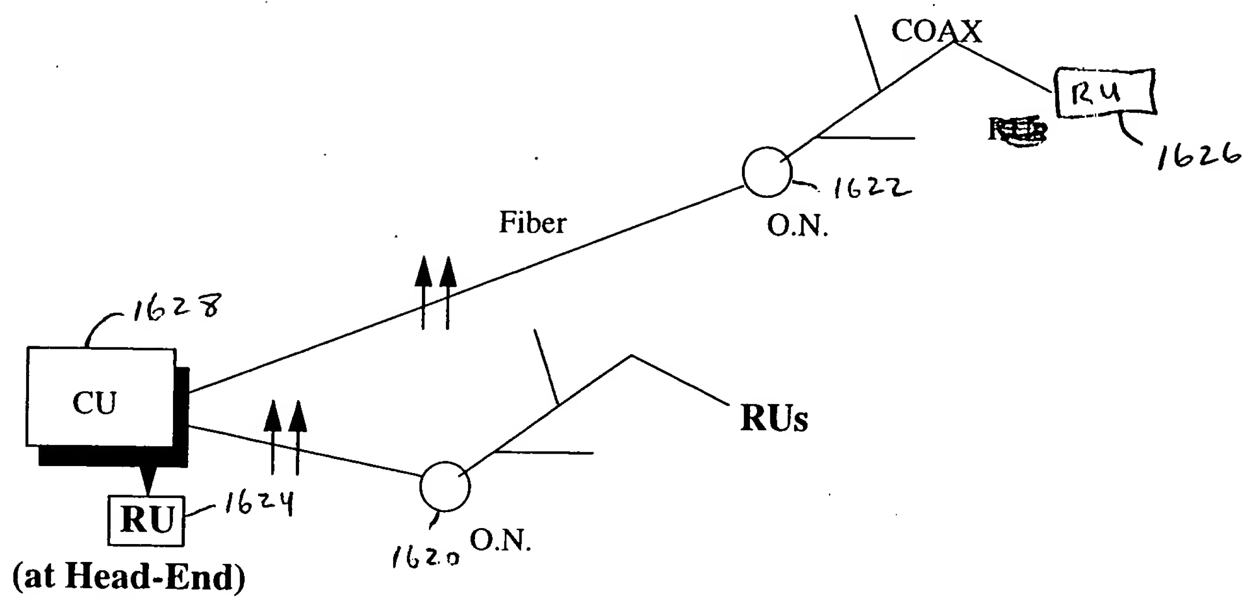
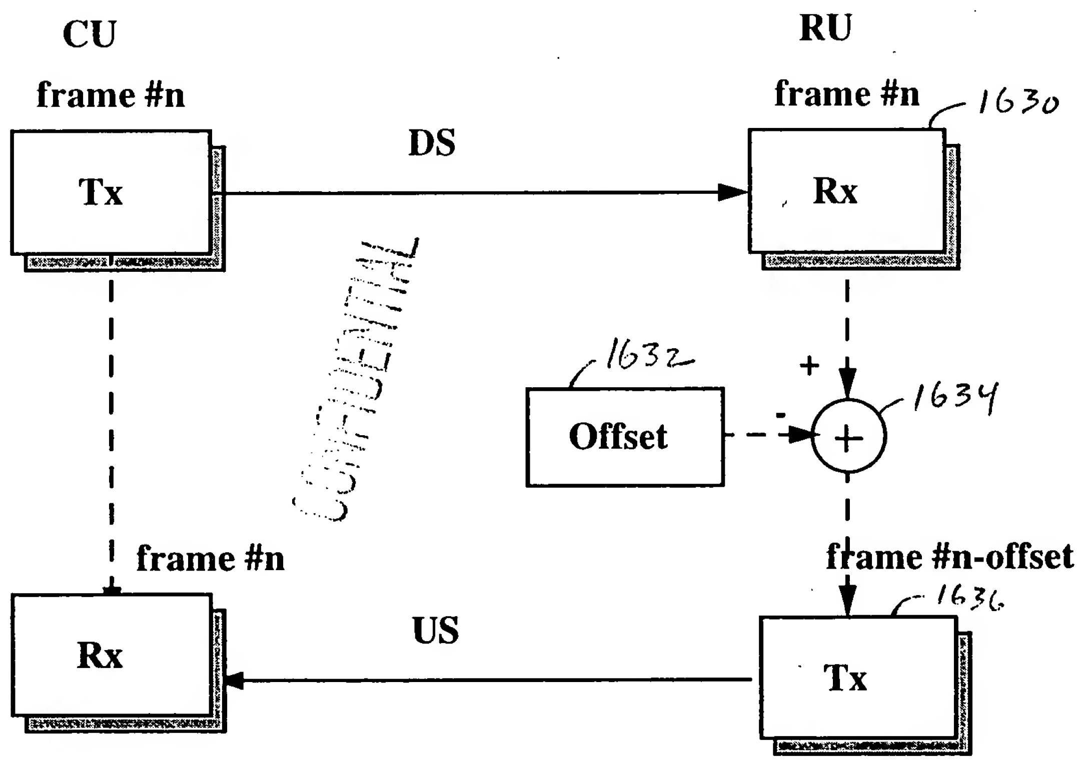


FIG. 66



Total Turn Around (TTA) in frames = Offset

FIG. 67

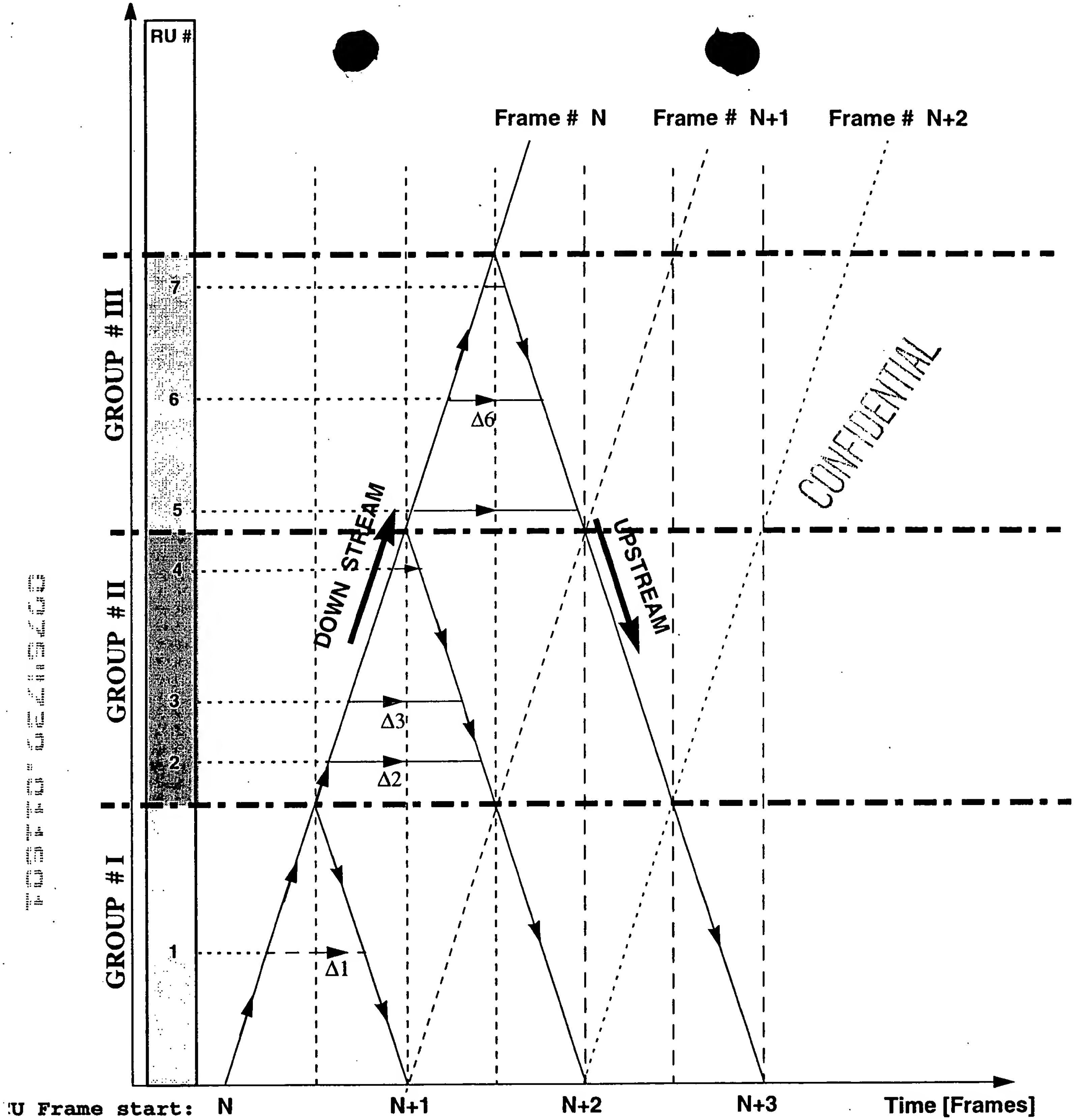


FIG. 68

~~Figure 3.1: Frame start propagation along the channel~~

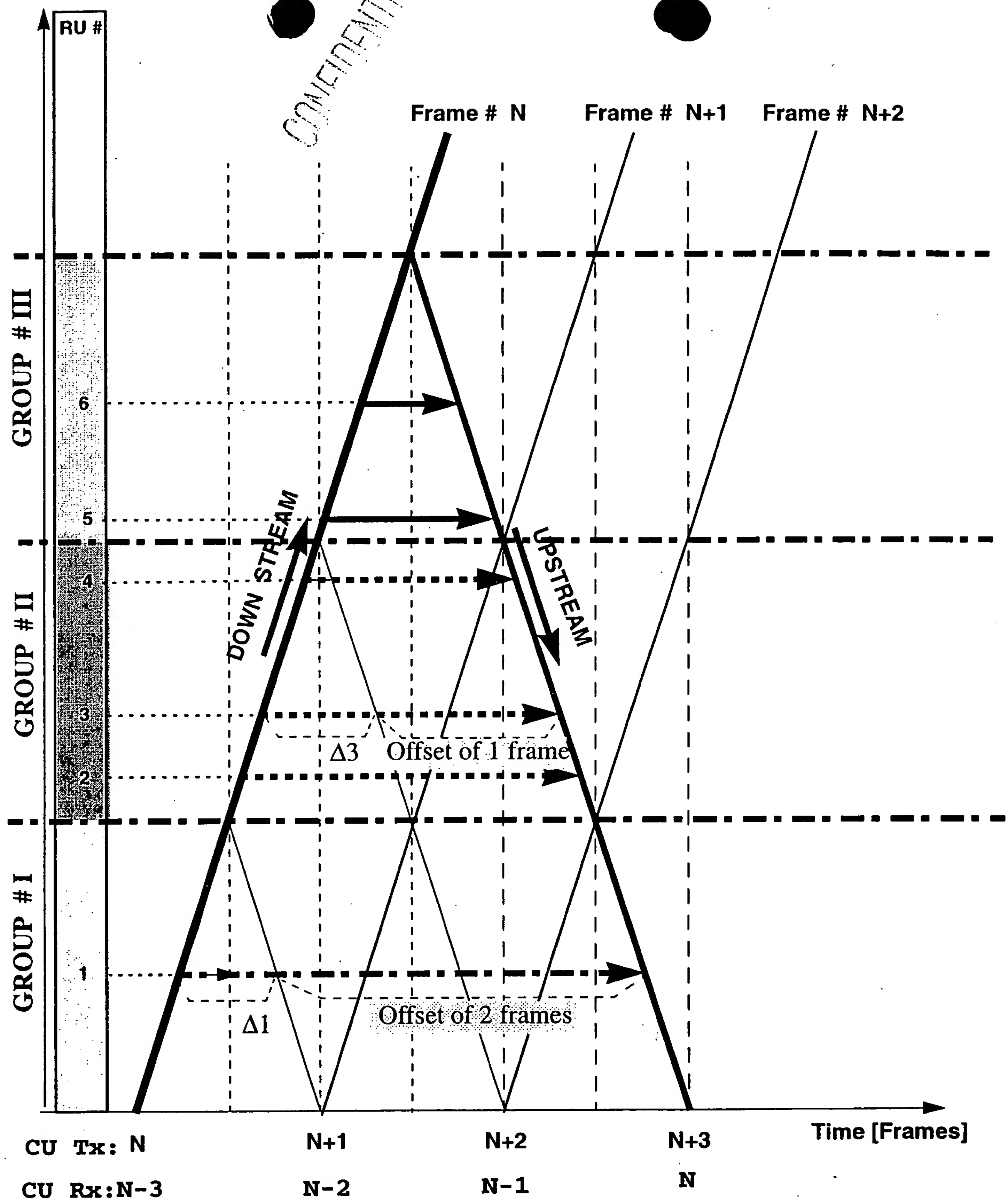


FIG. 69

~~Figure~~ Control message (downstream) and function (upstream) propagation in a 3 frames TTA channel

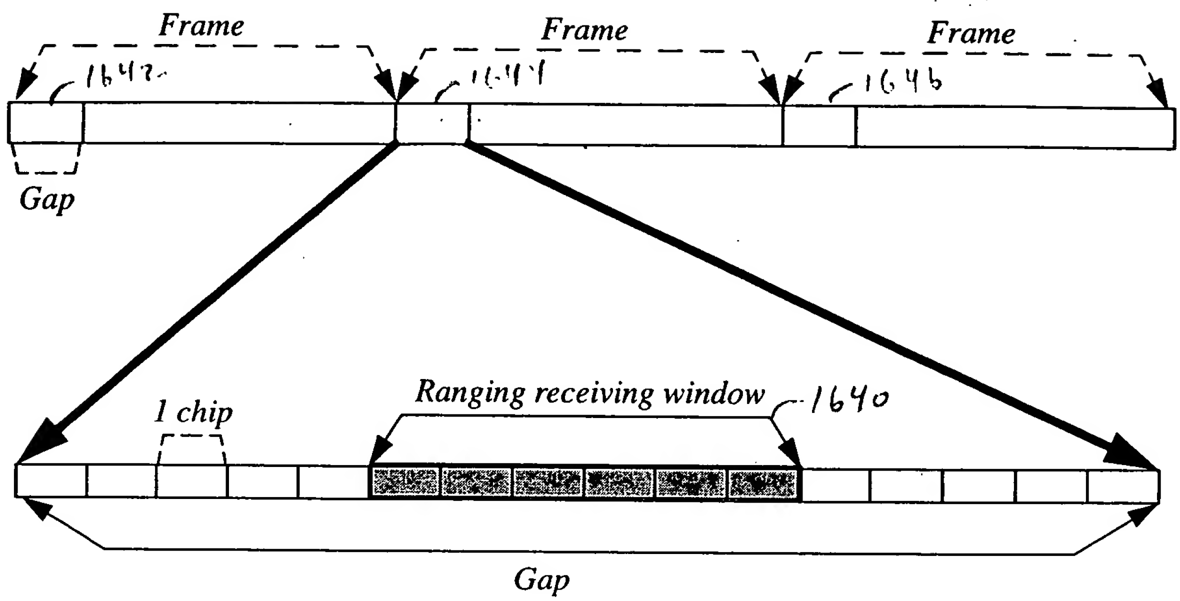

Frame
Frame
Frame
1642
1644
1646
Gap
1 chip
Ranging receiving window
1640
Gap

FIG. 70

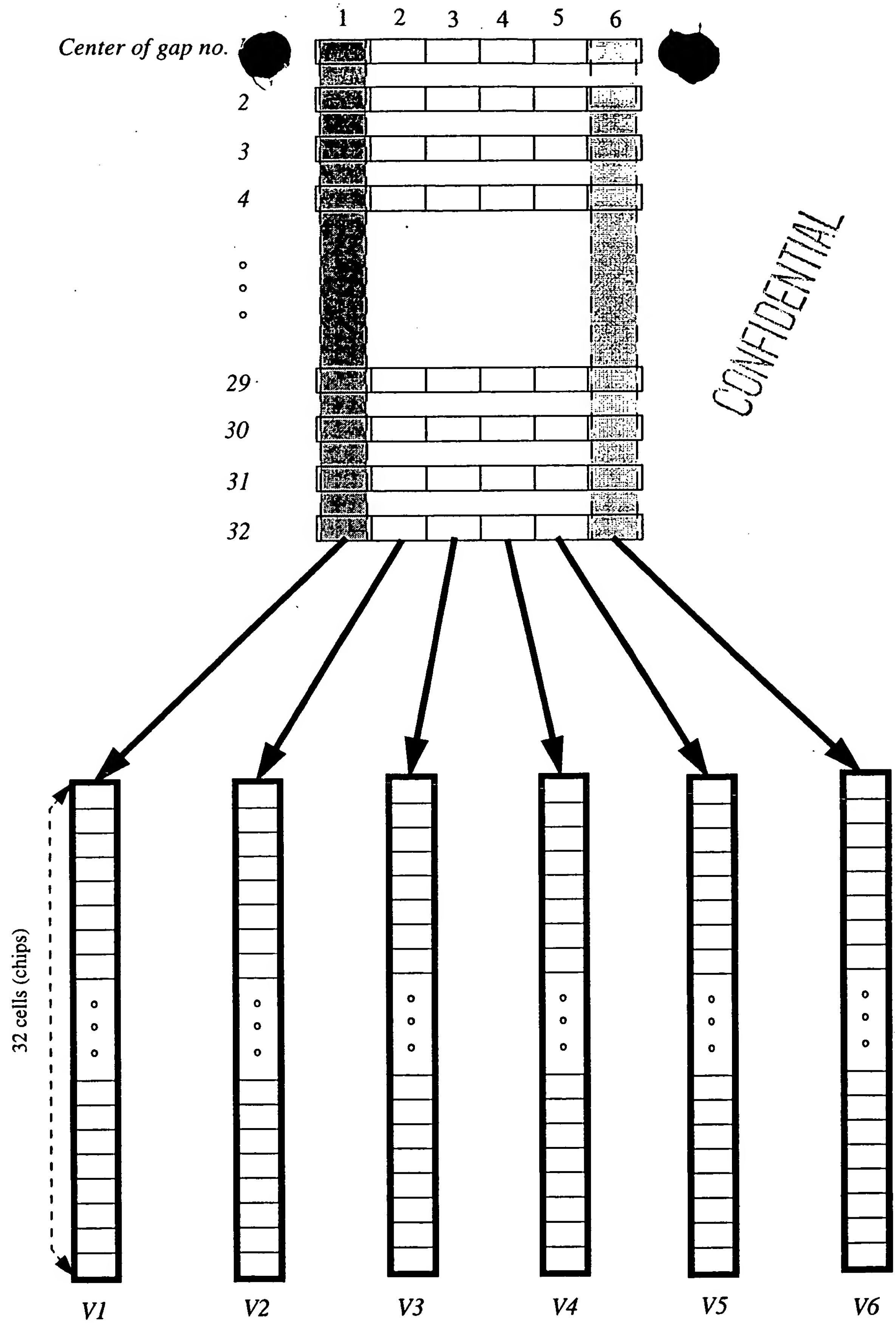


Figure 3.4: Overall view of the CU sensing windows in a "boundless ranging" algorithm

FIG. 71

6

Chip\FR	1	2	3	4	5	6	7		33
1	0	0	1	0	0	1	1	...	0
2	1	0	0	1	1	1	1	...	
3	0	0	0	1	1	1			
4	0	0	0	1	0	0	0	...	0
5	0	1	0	0	1				
6	0	0	1	1	1				
7	0	0	0	1	1				
8	0	0	0	0	1	0	0	...	

FIG. 72